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UNITED STATES NAVAL INSTITUTE PROCEEDINGS

VOL. NO. 52, NO. 5 MAY, 1926 WHOLE NO. 279

MILITARY COMMUNICATIONS

BY LIEUTENANT COMMANDER B. SAUNDERS BULLARD, (CC) U. S. NAVY

"Eyes to See With and Ears to Hear With"

EDITOR'S NOTE: Submitted in the Prize Essay Contest, 1926. Although not awarded the prize or honorable mention, the article was considered so important by the Board of Control that it was decided that it should be published in the PROCEEDINGS. (See Discussion page 925).

AT THE present time the entire civilized world is dependent for its existence upon ways and means of communication. During the long days of peace, commercial life, upon which the prosperity and contentment of the civilized world depends, could not function without adequate and rapid methods of communication. If by reason of the greatest calamity that the world has ever known, all of the now recognized means of communication were suddenly to be wiped out of existence, the world as we know it would retrogress to a condition approaching that of barbarism. The Bible gives us a very good example of what happens when means of communication are destroyed. By suddenly destroying the means of communication, the All Highest took the most effective method of prohibiting the construction of the Tower of Babel. In fact, the history of the world—ancient, medieval, and modern—is the history of improvements in methods of communication. Let us trace very briefly, the improvements that have been made in communications from before the dawn of history until the present time.

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The first man, be it Adam or the evolution from a simian ancestor, found it necessary to communicate his thoughts and ideas to his fellows. His method of communication was first by pantomime or sign language. This was soon found to be inadequate, and to take its place, the first crude spoken language was evolved. As the population of the world grew and spread over the lands of the earth there came the necessity of communication between tribes and villages. This communication was first by word of mouth via runners, and then, as this method became in turn insufficient, by means of written characters. As the world progressed along its allotted path there was always a striving toward the speeding-up of communications, meaning originally the speeding up of the means of transportation. First there was the runner on foot. Then the draft animals, such as the ox, the donkey, the camel, and the horse, were pressed into service for increased endurance and speed of communication on land, not to mention the dog for use in the frozen wastes of the north. On the sea the ship, propelled by sails and dependent for its speed upon the variable winds of heaven, followed closely upon the war canoe and the slave-propelled galley. For many centuries the horse on land and the sailing ship on the sea remained the acme of speed for transportation and communication. Then came an invention that revolutionized the whole question.

The invention of the steam engine with its subsequent application to the railroad locomotive and to the marine engine, speeded up the then only known method of long distance communication, but even this increase in speed was not enough to satisfy an ever advancing world. Inventors everywhere were working on the problem of speeding up methods of transportation and communication. Morse finally evolved the telegraph, and from that time, our means of long distance communication ceased to be entirely dependent upon methods of transportation.

After Morse and the telegraph, came Bell and the telephone, another revolutionizing invention which in reality carried the world back to one of the first methods of communication, that of communicating by means of the spoken word. Then came Marconi and the wireless or radio telegraph, and finally DeForest and a host of others, who developed and perfected the radio telephone.

This brief description brings us down to the present day and should serve to drive home the obvious fact of the great importance

of communications in our everyday life. If the world could not function in time of peace, without adequate methods of communication, it is not hard to imagine the chaos into which it would be plunged in time of war, if the various systems or methods of communication should fail to perform their allotted functions.

In time of war, communications will be one of the vital, if not the most vital, factor in the proper and effective prosecution of any future military campaign. By military communications is meant every method now known or that will be known in the future, for the transmission of orders or information. The commander-in-chief of an army on land or of a fleet on the sea, would be absolutely helpless without an efficient communication system. For the transmission of orders and intelligence reports, he is entirely dependent upon methods of communication. It is not a very rash statement to make, to state that, in a conflict between two military forces, equal in all respects, victory will perch upon the banner of that force having the most efficient communication system.

With the great importance of communications for military purposes perfectly obvious, it might not be remiss to ask just what the United States has done toward establishing and maintaining an efficient communication system, capable of serving its military needs in time of war? Probably the best method of approaching this question is by a discussion of the various methods of communication now in use. These are as follows:

1. Voice
2. Mail
3. Pigeons
4. Visual signals
5. Telephone
6. Telegraph
7. Cable
8. Sound
9. Radio telegraph
10. Radio telephone

Communication by means of the human voice, either with or without the use of a megaphone or other form of loud speaker, needs no discussion. This method naturally can only be used for the transmission of orders and information over comparatively short distances, and even then suffers from the great disadvantage of being many times misunderstood. Neither does communication by mail require any great discussion. This method of communication as considered in this paper includes all methods for the transmission of the original copy of written orders or information with the exception of the transmission of mail by pigeons. In other

words, this method of communication requires the physical transmission of a written document.

Communication by means of pigeons is also a physical transmission of a written document. Both the Army and Navy have established pigeon services, and during the World War, these birds performed very valuable services. The Director of Naval Communications has stated that the Naval Pigeon Service consists of twelve lofts and approximately 800 birds, under the care of specially qualified enlisted men. Pigeons in the naval service are of use only to the aviation branch inasmuch as they are dependent upon a fixed base or house. For ship or fleet work they are of no value in a communication sense.

Communication by means of visual signals is accomplished by many methods, among which are flag hoists, semaphores, blinker lights, heliographs, and searchlights. This means of communication is in reality local in character and the efficiency can only be improved by more efficient personnel within the various units, be they military or naval in character. Members of the Signal Corps of the Army and the signal forces aboard ships of the Navy are at all times endeavoring to increase the efficiency of the personnel that operate the various kinds of visual signals. This method of communication is, in the last analysis, a method usable only over short distances, and although of great importance in its place, is but a minor factor in the general field of military communications.

Communication by means of the telegraph and telephone is a very highly organized industry in the United States, this country being honey-combed by a network of wires. Purely military telegraphs and telephones in time of peace are restricted more or less to those necessary for interior communications, the government owned telegraph and telephone lines being comparatively few in number. Dependence during time of war is placed in the highly organized and efficient commercial companies established, expanded, and controlled by private capital.

The control of all telephone lines in the United States, with the exception of a few minor systems, is in the hands of the American Telephone and Telegraph Company and its associated companies, the whole known as the Bell System. The American Telephone and Telegraph Company is the parent organization or the trunk of the tree, while the associated companies are what might be called the branches. There are seventeen associated companies each con-

trolled by a local organization. The main offices of the parent company are located in New York City and as far as control over the associated companies is concerned, it is more or less limited to the preparation of plans and the study of questions of policy. The parent company also owns and controls the Western Electric Company and what is known as the Long Lines Department, both of whose main offices are also in New York. The Long Lines Department is an organization which connects the seventeen associated companies through the medium of the long-distance lines. These lines are entirely owned by the parent company.

The function of the Western Electric Company is to manufacture equipment and supplies, and to purchase such supplies as it does not manufacture, for the entire organization of the Bell System. The principal factory of the Western Electric Company is located at Hawthorne, near Chicago. This plant covers 207 acres of ground and is equipped for the manufacture of all apparatus required in electrical communications.

The magnitude of the Bell System is shown by the fact that it operates 39,600,000 miles of wire and 11,235,000 telephone stations, besides connecting with over 4,000,000 other stations owned by smaller companies. It includes on its payroll about 330,000 employees. The total investment of the system for the plant and equipment is over $2,300,000,000, while the average annual expenditures are over $1,000,000,000; in other words, the expenditures are over three times as great as the amount appropriated by the Federal Government for the support of the United States Navy.

For communication by means of the telegraph, the United States is dependent upon two major private concerns, the Western Union Telegraph Company and the Postal Telegraph Company. In addition there are several minor companies, such as the Federal Telegraph Company of California, which operates telegraph lines between points on the Pacific coast of the United States. The telegraph system within the borders of this country is very efficient and very complete, reaching practically every remote and out of the way part of the land. The development of these telegraph systems is entirely due to the initiative of private capital with little or no government aid or assistance. In addition to the highly organized and established telegraph companies, the United States is also served by the telegraph systems established by the various railroad companies. These systems are ordinarily used only for

the business of the individual transportation company, but they would be available to the government for military purposes in time of war.

In the field of communication by cable, the United States now lags far behind the rest of the world. The development and extension of this method of international communications has been left practically to private capital with little or no help from the government. In fact the only cable owned by the government is the cable running from the northwestern corner of the United States to Alaska. The lack of absolutely American controlled cables is due, of course, to the scarcity of overseas possessions of the United States. Predominance in the field of submarine cables is held by the British Empire. The fact that the sun never sets on the Union Jack may create severe military difficulties, but it has the advantage of allowing the British lion to establish a world-wide system of communications, without depending upon the friendship or good will of any other nation.

It will probably be of interest to list the most important of the cables that are operating at the present time. These are as follows:

British Companies. The Eastern Cable Company, together with its associated companies, operates cables in the North and South Atlantic, the Mediterranean Sea, the Indian Ocean and the Far East.

The "All Red Cables" are owned and operated by Great Britain, the Dominions of Canada and New Zealand, and the Commonwealth of Australia. They connect Great Britain with Canada, and Canada with Australia.

Danish Companies. The Great Northern Telegraph Company operates cables in northern European waters and in the Far East.

French. The French Government owns and operates cables in the North and South Atlantic Oceans, the Mediterranean Sea and the Indian Ocean.

Dutch. The government of the Netherlands owns and operates cables among its possessions in the East Indies.

United States. The "All Americas" Cable Company operates cables connecting various points in North and South America.

The Western Union Telegraph Company operates cables across the Atlantic and to various points in the West Indies.

The Postal-Commercial Cable Company operates cables to Europe and to points in the West Indies in the Atlantic, and in the Pacific to Japan, China and the Philippine Islands.

A cursory glance at the above list would give the impression that the United States is not in reality badly off in regard to cables. It is, however, because there are no direct cables from this country to Europe except to Great Britain and to France. It has been stated that cables are projected from Germany to the Azores, and from Italy to the Azores, where both will connect with cables to the United States. Inasmuch as the Azores are a Portuguese possession, Portugal will actually control the traffic over these lines. Also the cables operated by the Postal-Commercial Cable Company across the Pacific, actually connect at the Bonin Islands and at the Island of Yap, with cables to Japan and China respectively, which cables are under the control of Japan.

Probably the worst feature of the cable situation from the point of view of the United States lies in the fact that there is no factory in the country equipped for the manufacture of submarine cable. The manufacture of this material is in reality a special art, and requires special equipment, special material and very skilled workmen. Brigadier General J. J. Carty, O.R.C., U. S. Army, of The American Telephone and Telegraph Company, has stated that a new plant being constructed for the Western Electric Company at Kearny, New Jersey, is to contain a unit for the manufacture of submarine cable, "if conditions justify it." In view of the fact that at the present time, this country is entirely dependent upon foreign manufacturers for the supply of submarine cable, the Federal Government in connection with preparations for possible future war should make conditions that the Western Electric Company would be justified in constructing the projected submarine cable plant.

Communication by means of submarine cables in time of war, suffers from the disadvantage that cables may be cut or diverted. This was exemplified during the World War by the diversion of the German cables across the Atlantic. The general location of all cables now in operation is known and it would be an easy matter for any belligerent to cut them and thus put them out of commission. In the event of war in the Pacific, there is no question but what the one cable connecting the mainland with Hawaii, Midway Island, Guam, and the Philippines would be cut at the

opening of hostilities. In the preparation of all war plans, this fact should be borne in mind, and it is believed that the United States should immediately take steps to lay an additional cable across the Pacific, keeping the location of the cable a military secret. This is absolutely essential on account of the fact that the only over-seas possessions of the United States outside of the West Indies, are scattered all the way across the Pacific Ocean. The laying of this cable should be made a question of military preparedness. It would be too late should the United States await the opening of hostilities. It should be laid in the near future, for we must remember that at present we are entirely dependent upon foreign concerns for the supply of submarine cable. It is doubtful if enough cable to span the Pacific Ocean could be manufactured in less than three years, and even that time would be extended if it so served the interest of the foreign government manufacturing the cable. This might also be used to bolster up the argument for federal aid to the Western Electric Company in constructing a purely American submarine cable plant.

Communication by means of sound is restricted in this paper to under-water sound apparatus. The World War gave a great impetus to the development of the listening devices, which came into use as a means for locating enemy submarines. Since the war, however, the development of apparatus for the transmission and reception of under-water signals has suffered from the lack of funds. The development and perfection of this apparatus should be vigorously prosecuted as a great addition to military communications, inasmuch as this method is the only one known by which communication can be had with submarines when running fully submerged. The Navy Department has done all that was possible, with the limited appropriations available, toward the development and installation of under-water sound apparatus, and is extending this method of communication as fast as time and funds permit. It has been stated that submarines running fully submerged have been able to communicate at distances of fifteen miles, and that the apparatus is accurate within two degrees for determining a bearing. Experiments, which give every indication of being a success, are being conducted toward the accurate determination of ranges by means of under-water apparatus.

By far the most important method of communication from a military point of view is by means of radio telegraphy. This part

of the field of communications is one in which the United States Government has taken a very prominent position, the pioneer work in this field being undertaken by the Navy Department. It was realized early in the development of radio telegraphic apparatus that it would play an important part in the transmission of orders and information over great distances. The first radio installation was brought to this country in 1898, but it was not until 1904 that there was any expression of policy by the Federal Government in regard to radio matters. In that year a policy was recommended by what has been known as the Roosevelt Board. This board was appointed by President Roosevelt to study the radio activities and needs of the various departments, and to make recommendations regarding the federal policy that should be adopted. The members of the board recognized the immense military importance of radio to the Navy and recommended that the Navy Department should be the part of the government to undertake the development and expansion of this method of communication. The board also recommended that the Navy should maintain and operate a complete chain of coastal stations and should handle all messages for other departments of the government. It was also recommended that the War Department should operate stations in military areas as part of the system for national defense.

The report of the Roosevelt Board was approved by the president, and although the report is now almost forgotten, the Navy Department has always insisted on the rights conferred upon it as well as assuming all of the obligations required of it.[1]

From this beginning sprang the U. S. Naval Radio Service, which is now a part of the Naval Communication Service under the Director of Naval Communications. This service is part of the Office of Naval Operations and is an operating department pure and simple. The Director of Naval Communications is responsible for the operation and administration of all systems of communication in use by the Navy; the Bureau of Engineering has cognizance over the development, supply, and maintenance of all material, while the Bureau of Navigation supplies and trains the necessary personnel.

The office of the director of the Naval Communication Service is organized as follows:

Under the director there is an assistant director who handles all miscellaneous matters, such as war plans, questions of policy, ques-

[1]For new policy see page 590, March, 1926 PROCEEDINGS.

tions involving legislation and liaison between the Navy and other departments of the government.

The work of the office proper is divided into the following divisions:

(1) Traffic, handling all land wires, cables, and general radio matters.

(2) Navigational devices, handling all questions in connection with radio compasses, sound signals, pilot cables, weather reports, broadcasting, and pigeons.

(3) Commercial, handling all commercial traffic.

(4) Code and signals, handling the compilation of signal books, codes and ciphers, cryptographic section and the registered publication section.

In addition to the personnel of the office of Naval Communications, there is a Pacific Coast and an Asiatic Communication superintendent—the head of the Traffic Division of the Office of Naval Operations acts as Atlantic Coast superintendent. The function of these three general superintendents is to act as coordinators for the traffic going from one naval district to another.

The different systems of shore communications are actually directly under the commandants of the various naval districts. Under the commandant and responsible directly to him, is an officer known as the district communication officer. This officer handles all the details connected with the transmission and reception of radio communications. In each district there is also an officer known as the radio material officer, who handles all questions concerning the maintenance of material within his district.

Apparatus upon units of the fleet for transmission and reception of radio communications has become very complicated and complex, dependent upon the type of ship and the number of circuits required for simultaneous reception and transmission of messages. First-line capital ships naturally have the most complicated system of radio apparatus. Light cruisers, destroyers, submarines and auxiliaries are supplied with such radio apparatus as it is believed will be needed for inter-ship and ship-to-shore communication in time of war. Every ship, large or small, has now an officer detailed as communication officer. He is directly responsible for all communications carried out by his ship. At the present time, battleships have very elaborate communication organizations and there has been certain agitation in the battle

fleet to make the communication officer of each battleship head of department. One objection to this arrangement lies in the fact that officers of sufficient rank to be heads of departments aboard battleships are not sufficiently skilled in the art of communications. It would appear that for the present at least the communication organization aboard ships of the Navy will probably be made a sub-department under the navigator.

What has been done in the United States toward the establishment of radio companies financed and operated by private capital? At the outbreak of the World War there were only two private companies worthy of the name, operating for general radio purposes. The Marconi Company of America operated shore stations along the sea coasts and lake regions of the country, in addition to owning the radio installations of many of the ships flying the American flag. This company also operated a high-power station in California for communication with Hawaii and had contracted to build another high-power station on the Atlantic Coast for communication with a similar station in Norway constructed by the English Marconi Company.

The Federal Telegraph Company of California, the other company doing an operating business at the outbreak of the World War, operated low-power stations on the Pacific Coast and installations on ships in the Pacific trade. The real importance of the Federal Telegraph Company of California lay in the fact that this company was the owner of various valuable radio patents among which may be mentioned the "arc" transmitter.

At the commencement of the World War there was nothing in the basic law of this country prohibiting the erection on United States soil, of radio stations owned and operated by foreign companies. There was in operation at this time a high-power station at Sayville, Long Island, owned by a German radio company for communication with the station in Nauen, Germany. There was also in process of erection a second high-power station at Tuckerton, New Jersey. This station was being built by a German company for a French company, and was to be used for communication with a station at Elvese, Germany.

In order to perform our duties as a neutral nation, United States Navy personnel was put in charge of these two stations at the outbreak of the World War. When the United States entered the war, the Navy took complete charge of the stations and operated them as part of the Naval Communication System.

During the war the Alexanderson machine, generating a high-power, high-frequency, alternating current, and of great value for radio transmission by the use of continuous waves, was developed by the General Electric Company. At the conclusion of hostilities it appeared that the only market for this machine other than the Federal Government, was the English Marconi Company. In order to keep this machine for strictly American use, the General Electric Company was prevailed upon to establish an American market by the formation of a strictly American radio company. It was in this fashion that the Radio Corporation of America came into existence.

The growth of the Radio Corporation of America has been little short of phenomenal, until today the United States finally has an American-owned, highly organized, and efficient private radio company, which in time of future war would undoubtedly be used to augment the Naval Communication Service. One of the first stations acquired by the Radio Corporation of America was the Tuckerton station above referred to, which was acquired from the French owners. The Sayville station was retained by the Navy, and now forms part of the high powered radio system of the Naval Communication Service.

The old American Marconi Company, which in reality was owned and controlled by British interests, went out of existence, the Radio Corporation of America taking its place in the American radio field. The Federal Telegraph Company of California continues to operate, but most of that company's business lies in the manufacture of radio equipment for which it holds the patents.

The Federal Government has always looked with favor upon the establishment and development of radio companies by private capital. In witness of this the State Department vigorously supported the efforts of the Federal Telegraph Company of California to obtain a concession from the Peking government to construct a chain of radio stations on Chinese territory. This concession was finally granted in spite of spirited protests on the part of the Japanese. With the consent of China the concession was transferred by the Federal Telegraph Company of California to a new company, the Federal Telegraph Company of Delaware. This concern was organized solely for the construction of the stations in China, and is jointly controlled by the Radio Corporation of America and the Federal Telegraph Company of Cali-

fornia. The construction of the stations has not as yet been commenced, and with the present chaotic state of the Peking government, it is hard to prophesy when the ground will actually be broken.

Let us return once again to the consideration of the Naval Communication Service, for it is this service that will be called upon to bear the brunt of the requirements for military communications in time of war. It has been stated that the mission of the Naval Communication Service is, "to furnish quick communication between the Navy Department, the fleet, and the units thereof, and all outlying possessions"; this mission should be expanded to include the following, "to handle all radio traffic between the War Department and the commander-in-chief of any expeditionary force of the United States Army operating over-seas."

In order to accomplish the mission allotted to it, the Naval Radio Service, in addition to the sets installed on units of the fleet, consists of the following systems of shore stations:

a) Primary system, consisting of thirteen high-power stations with ranges from 2,500 to 5,000 miles. These stations are so situated as to insure communication with units of the fleet operating in any waters, in addition to insuring constant communication with our over-seas possessions.

b) Intermediate system, consisting of twenty-three medium-power stations, with ranges from 1,000 to 2,500 miles. These stations are for direct communication from ship to shore, and are a connecting link between the units of the fleet and the primary system mentioned under (a) above.

c) Coastal system, consisting of seventy-two low-power stations, with ranges less than 1,000 miles. These stations are so situated that small vessels operating along the coasts will always be in communication with shore.

In addition to the three systems mentioned, the Naval Radio Service also maintains two experimental laboratory stations, in addition to fifty-five radio compass stations of which more will be said later.

Certain of the primary stations, namely, Annapolis, Sayville, San Juan, Balboa, San Diego, San Francisco, Pearl Harbor, Guam and Cavite, form what is in reality an independent system for long-range communication. These stations work on a sched-

ule and use the broadcast for most of their transmission. This super-primary system in reality forms a radio chain, practically insuring the Navy Department and the operating heads of the Navy of being in constant communication with our naval forces operating in any waters.

Mention has been made above of the chain of radio compass stations maintained and operated as part of the Naval Communication System. In the strict sense of the word, in addition to being excellent aids for navigation, these stations are communication centers, inasmuch as they are used for imparting information of ships at sea. Sea-going personnel are by nature rather conservative and not prone to take up new wrinkles with anything approaching enthusiasm, consequently not much faith was placed in the radio compass when first installed. The true worth or value of these stations, however, has been demonstrated over and over again, until now "those who go down to the sea in ships" have been convinced that this apparatus is a great addition to the existing aids for navigation. In time of war, these stations in addition to being used as aids for navigation, would be used for plotting and tracking enemy vessels approaching the coast.

Somewhat similar in its action to the radio compass is the radio beacon. These beacons are installed and controlled by the Lighthouse Division of the Bureau of Commerce. Radio apparatus is installed on lightships and during fog or thick weather of any kind, distinctive radio signals are sent out at certain set intervals of time, similar to the various distinctive beams from light houses. Ships equipped with radio compasses and approaching the coast during thick weather, can obtain bearings from these beacons, and thus plot their positions with a high degree of accuracy. For pilotage work, the radio beacon has the advantage over the shore radio compass station, in that a great number of ships can obtain bearings at the same time from the beacon, whereas with the radio compass station but one ship can be taken care of at a time.

It is more or less of a problem as to what military use will be made of communication by means of the radio telephone. The great development of the radio telephone and the almost mushroom-like growth of broadcasting stations throughout the length and breadth of the United States as well as the rest of the world, is a matter of current history. Receiving instruments, from the simplest one tube, dry battery set to the last word in reception re-

finement, are installed everywhere, until at the present time a goodly proportion of the civilized world is reaping its pleasure from this source of entertainment. For strictly military use, transmitters and receivers have been installed on shipboard but have not been universally used. The radio telephone has also been used for transmitting orders and information to aircraft flying in formation. For this use the transmitting set is installed on the ground, individual planes being equipped with receiving sets only. It seems hardly probable that the radio telephone will ever supersede the radio telegraph for military use. For purely military purposes it seems probable that the radio telephone will be used more for the transmission of propaganda than for any other purpose.

The World War proved beyond a question that with proper use, propaganda is an effective moral weapon. In the next war it seems probable that whatever powers are involved as belligerents, each will be activated by a desire to drive home its story to the remaining neutral nations. Radio telephone transmitting stations, with power to broadcast over great distances, serve as a medium for a nation to put over its story to the individual citizens of other countries. Nations will endeavor by means of the radio telephone to sustain the morale of their own civilian population, as well as to create and cultivate public opinion in neutral countries. They will also endeavor to break down enemy morale by broadcasting propaganda with that sole end in view. It has been stated many times that the greatest cause of the collapse of the Hindenburg Line during the days that preceded the Armistice, was the weakening of the morale of the German military forces by the propaganda of the Allies. With that example of the influence of propaganda fresh in our minds, it seems safe to predict that during the next war, propaganda will be used to even a greater extent than it was during the World War, and it seems certain that the radio telephone will prove to be the most effective medium for the dissemination of such information as any belligerent nation desires to broadcast.

Probably the only disadvantage of radio, both telegraph and telephone, as a means of communication, lies in interference. By interference is meant static or atmospheric electrical disturbances, as well as true interference from signals sent out from other stations. Improvements in apparatus and in selectiveness of receivers have solved to some extent the disadvantage and the troubles

caused by interference. One method in use for the elimination of interference troubles is by restricting the different types of transmitting stations to certain specific ranges of wave lengths or frequencies. In the United States the assignment of wave length ranges is in the hands of the Department of Commerce. At present the wave length ranges for the various types of transmitting stations are as follows:

Amateurs, 150 to 200 meters.

Broadcast, 200 to 600 meters.

Marine stations including radio compass stations and radio beacons, 600 to 1,053 meters.

Marine radio telephone sets, 1,053 to 1,277 meters.

Universities and experimental laboratories, 1,277 to 1,304 meters.

Government continuous wave and interrupted continuous wave, 1,304 to 1,579 meters.

Marine continuous wave and interrupted continuous wave, 1,579 to 2,500 meters.

Government exclusive, 2,500 to 3,158 meters.

The Department of Commerce also assigns the wave length to be used by the various stations when licenses to operate are issued. This department does not assign wave lengths to stations operated under the Naval Communication Service, but all assigned wave lengths are reported to the Department of Commerce for purposes of information.

The latest development in the field of radio and one in which rapid strides are being made at present is in communication by the use of high frequency waves. Very high frequencies of course mean very short wave lengths. These short wave sets are of very low power and from the success obtained up to the present, it seems as if this type of radio transmission might be the answer or the solution to most of the troubles from interference. For example of what already has been accomplished in the field of short wave transmission the following may be mentioned:

The experimental set installed by the Navy at the Bellevue Research Laboratory has been constantly copied during certain hours of the day by the receiving station at Los Banos, Philippine Islands. This transmitter is of very low power, being less than two kilowatts.

Lieutenant H. P. Roberts of the U. S. Army Signal Corps, using a very low-power short wave set at Fort McKinley, near Manila, Philippine Islands, has been in communication with sta-

tions in Maryland, in the United States, and in Cape Town, South Africa.

What developments and refinements in this type of radio transmission will be made in the near future can hardly be predicted. No one can be enough of a prophet to forecast or foresee the advances that will be made in the next few years.

Practically every means of communication now in use and that will be used in time of war for military purposes has been discussed in some fashion, even though such discussion has been made in a rather sketchy manner. What conclusions can be drawn from what has been said in regard to military communications and what is the status of the United States as regards preparedness for war from the point of view of communications?

The means of communication that will be of the most vital value in time of war are those means of communication capable of being used for transmission of orders and information over long distances. Local or short distance methods of communication are also of importance but not nearly so much as are long distance methods.

If war should come to the United States at the present time or at any time in the immediate future, we would find this country very well prepared as regards telegraph and telephone stations within its borders. The existing telegraph and telephone lines could care for all of the domestic needs of the military services, though even here the Federal Government would find it of utmost importance to appoint some coordinating influence to decide upon the priority for the great volume of communication traffic. The appointment of this coördinator would be absolutely necessary if any degree of efficiency in communication is to be achieved. In time of war there will be three competitors for service from the telegraph and telephone companies—the Army, the Navy, and the civilian population. All of the traffic for the Army and the Navy will be solely for military purposes. Inasmuch as the greater part of the industrial civilian population will be engaged in the production of goods to be solely used by the military services, a great part of the civilian traffic will also be military in character. The job of the coördinator of telegraph and telephone traffic will be to decide upon the priority to be accorded these three factors in the military defense of the nation.

Pausing once again for the consideration of radio communication, we find that the United States has a highly organized and

highly efficient government system in the Naval Radio Service, in addition to the efficient privately-owned company, the Radio Corporation of America. For military purposes in time of war, it would be necessary to have one central control for all radio communication, and this control would undoubtedly be vested in the Naval Communication Service. The high-power, super-primary stations for long distance communication, now controlled by the Naval Communication Service, apparently should handle all of the necessary traffic in time of war.

The increase in the number of radio telephone broadcasting stations has been nothing short of phenomenal in the last few years. The Federal Government should give as much encouragement as possible to these stations for they will all prove to be of immense value as agencies for the distribution of news and propaganda in time of war. The almost unlimited number of receiving sets in the United States will all be tuned in to whatever is on the air in time of war. Any potential enemy will undoubtedly take advantage of this condition to broadcast his propaganda. In order to combat this weapon aimed at the morale of our civilian population, it will be necessary for the government to fight fire with fire.

An endeavor has been made in this paper to stress the vital importance of military communications to the United States. For purposes of emphasis certain very obvious facts have been repeated in the hope that instead of proving boring, that they will be of interest to the officer personnel of the Navy. The science or art of communications is somewhat analogous to the twin seagoing sciences, seamanship and navigation, in that it is of vital importance to the officers that are to command or operate our fleet in future war. It is as manifestly impossible for every individual officer to be a communication expert as it is for every officer to be an engineering or gunnery expert. There is no reason, however, why every officer, both line and staff, should not be familiar with the principles of communications, inasmuch as communications will play such a vital part in future war. It is not outside of the realm of the possible, that the shade of difference between victory and defeat may depend upon the efficiency of the Communication Service. With that the case, every effort should be put forward to make the communication facilities of the United States as efficient as it is humanly possible to make them.

THE VALUE OF THE SUBMARINE IN NAVAL WARFARE

BASED ON THE GERMAN EXPERIENCE IN THE WAR

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Editor's Note: The author of this article, Rear Admiral Spindler, was, during the war, on duty in the Ministry of Marine in the section charged with construction and development of submarines.

THE new Disarmament Conference proposed by the League of Nations for 1926 will re-open the question raised during the Washington Conference in 1921-22, which was much debated without being solved—namely, the extension of the restriction of naval armaments to the submarine. Again, as in Washington four years ago, debates are to be expected regarding the value or the uselessness of submarines, the inhumanity of their employment against merchant shipping in time of war, and the significance of the submarine weapon otherwise as a factor in naval warfare. In England, whose representatives were the spokesmen against the submarine, public opinion has lately been aroused anew against this weapon since the accident to the *M-1;* and one may regard the heated and exhaustive discussions in the press and the resolutions and arguments in the Parliament following that disaster as a basis for further debate in favor of disarmament.

The judgments passed on the value of the submarine, as debated by the individual nations, in the forum of the conference of the League of Nations, will be consciously or unconsciously colored by political aims. That nation which regards the existence of the submarine weapon in the hands of its probable enemies as a vital threat, will attempt to prove to the world that the value of this weapon, where otherwise employed than in the inhumane commerce warfare, is highly problematical, and will necessarily advocate the "abolishment of the submarine."

For this reason the time appears propitious for a strictly unbiased analysis of the question of submarine warfare and the fighting effectiveness of submarines from a purely military and technical standpoint; and nothing can be better chosen as a basis for this discussion than the historical facts and data pertaining to the German submarines during the war.

Only in this war were such large scale and comprehensive measures for attack and defense brought into play, and only in these operations were the full possibilities of the submarine thoroughly demonstrated. Further, the German submarine operations themselves were the fundamental cause of the present-day tendency to condemn the submarine entirely. Also, it should be noted here in advance that the military and technical possibilities of the submarines have not been notably improved beyond the type of German submarines which were last placed in active service. The increase in displacement in the submarine which has occurred in some navies of the world in the post-war period has brought with it nothing radically new. This will be discussed in detail later. Therefore those lessons derived from the German submarine war experience may be applied to the near future practically without exception.

Two explanatory remarks should be inserted in this introduction. In order to concentrate the following discussion on the principal factors under consideration, it will be restricted to a consideration of the principal operating zones of the German submarines: the North Sea and the waters around England. Further, in the interest of brevity, we shall not go into the question of the employment of mines by submarines, since this is not a question which is especially open to dispute.

An explanation is in order regarding the submarine commerce warfare which is discussed in the following paragraphs. After the war there was created an international feeling against any employment of the submarines against merchant shipping, which has lately been revived in England as previously noted, and which first assumed tangible shape in the Washington Conference in 1922. For this reason it might appear questionable whether such submarine activity need even be considered in the future. Opinions have always differed regarding the binding character of international law and treaties where a nation is engaged in a struggle for existence.

In reality, in the history of the past, might has counted for more than right in time of war. In any event it is certain at least that the present state of the treaties does not preclude the unrestricted employment of the submarines in the future. So long as the situation remains as it is, this method of the employment of submarines cannot be dismissed from military consideration.

The submarine warfare against England's overseas trade occupied the German submarines to a great extent during the entire period of the war and exclusively from the beginning of 1917 on. The discussion of the submarine commerce warfare will therefore follow in logical order in the treatment of the subject. The opportunities for the employment of the German submarines in connection with the purely military operations of the fleet were very restricted so that throughout the whole world, commerce warfare is understood when German submarine warfare is mentioned. In spite of this, however, the purely military operations of the submarines are by far the most interesting to the expert. The second section of this article will be devoted to that subject.

If one attempts to draw conclusions from the German submarine commerce warfare and its effects which shall be applicable to other nations in some future war, it is highly important that two factors should be taken into consideration which were of prime importance in their influence on the German submarine operations: the strategic situation in which the bases of the German submarines stood in relation to their principal enemy, England; and the sources of strength in material and personnel on both sides, particularly those which formed the basis and the reason for the development of the German submarine weapon.

No preparations had been made in the German Navy for the employment of submarines against enemy commerce prior to the outbreak of the war in 1914. The German naval authorities had developed no plan of operations whereby an enemy, England, could be attacked through her overseas commerce and thus become possessed of a weapon which would be really effective in operations against the vital nerve of the island empire. The number of submarines corresponded to the strictly military estimate as one of the numerous auxiliaries in naval warfare, in the sense that the decisive rôle was assigned to the battleships. Therefore, no preparations were made which had as their purpose an immediate in-

crease in the number of submarines under construction at the outbreak of war by drawing on the industrial strength of the nation. On the other hand, one might say that in 1914 the German Navy possessed a technically highly developed type of submarine which throughout the war was able to meet all the demands of the service. On the part of the enemies of Germany at the outbreak of the war there were lacking practically every means for effectively combatting the submarines. A characteristic example of their helplessness is the sinking of the three English cruisers in September, 1914, by the *U-9,* without the slightest counter-offensive.

Such were the starting points on both sides. The weakness of the allied naval forces in regard to submarine defense was a point of marked inferiority. The possibility offered the German Navy for a surprise attack by means of a new and already well-developed weapon which they had at hand was not utilized. In the future, such a combination of circumstances will not be encountered.

In the couse of the war the German submarine weapon was considerably strengthened by extraordinary exertions. On the whole, 343 new submarines were placed in service in Germany. In order to accomplish this enormous achievement, which could only be carried out by putting the submarine increase above the other interests of the national defense, Germany was favored by the highly developed state of her industry and technique, as well as by the fact that the fundamental material requirement, the raw material, was either in Germany itself or else in those areas open to her, and available to the munitions industries. In the same manner, the German Navy provided a supply of first class personnel necessary for the manning and command of these craft, a requirement which is of greater military importance for such vessels than for any other branch of the naval service. After the development of the anti-submarine measures the war service on board submarines exacted—aside from physical fitness—the highest degree of intelligence of every man in the crew, and further demanded a thorough military, naval and technical training which could not be improvised in a few months during the war. The fact that it was possible to select the supply of the needed personnel for the German submarines (which required in all about 13,000 men, including the highly trained replacement crews) was largely due to the fact that the German fleet served as a means of training a

reserve of personnel, from which officers, petty officers and special enlisted ratings could be carefully selected.

In regard to the development of the anti-submarine measures on the part of the enemies of Germany, one fact was in their favor—in fact it was their salvation—that was, the complete discontinuation of the submarine warfare from the summer of 1915 to the beginning of 1917 which gave the allied nations the time to develop and organize their anti-submarine offensive on a large scale after the short flare-up of the submarine warfare 1915 had made them aware of their danger. The different means of submarine defense are known to the naval expert. With regard to the offensive measures, mines and depth charges were by far the most effective. Of the 166 German submarines which were destroyed during the war as a result of the enemy anti-submarine measures; according to fairly exact information, thirty-seven were lost due to mines alone, thirty-three were destroyed by depth charges, while the other anti-submarine measures caused relatively much lower losses. Of the many defensive measures the very excellent development of the English convoy system for merchantmen proved an exceedingly great obstacle for the German submarine. Toward the end of the war the attack on a protected convoy meant the risk of the boat. As the submarine defensive measures were perfected the German submarine losses increased. However, in the struggle between the submarine commanders in the construction of new submarines on the one hand and the anti-submarine measures on the other hand, the Germans were not inferior. The English version that the submarine menace was overcome at the conclusion of the war is not in agreement with the facts of the case. Rather it was possible, even in spite of the increased anti-submarine measures in 1918, to maintain the submarine successes at the high level and to equalize the losses, which averaged about seven boats monthly, by new construction, and supply the necessary crews. With regard to the subject matter of this article there are two principal conclusions to be drawn from the above in this connection: the rivalry between the submarine and the anti-submarine measures with the progress of the war was very intense. In a broad sense, to this should also be added the mine operations against the submarine bases and the mine-sweeping tactics for clearing and keeping open the submarine routes. The more the submarines threaten the enemy's vital communications and the

closer these operations are conducted to the vicinity of the enemy coast and their patrols, the greater the danger to the submarines; but one cannot deny that in spite of all this, boats which are boldly and expertly handled will still have success. That is one conclusion. The second is the fact that in order to conduct submarine operations on a large scale with the purpose of forcing a decision with this weapon, the entire strength of personnel and material of the combatants will be involved to a very great extent both for attack and defense. More than with any other weapon, this service demands the requisite material replacement, owing to the complicated submarine construction, in order that the losses may be more than equalized by new construction.

The geographical situation of the two opposing powers, Great Britain and Germany, must also be taken into consideration as one of the decisive factors in the effectiveness of the submarine commerce warfare. On the one hand, the nation attacked, England, was dependent on her overseas commerce for the supply of essential foodstuffs. This circumstance led to the assumption that an energetic attack of the submarine might play a decisive rôle in the war. On the other hand, the attacking state, Germany, found herself in the worst conceivable strategic situation for the conduct of such submarine warfare. The German Bight, located in a small angle of the North Sea with the submarine bases close together, was much easier to blockade with mine fields than a long coast line with scattered harbors. The narrow channel between Dover and Calais and the stretch of water between Norway and Scotland offered further opportunities for blocking the submarine routes with mine fields. Further, the most important war routes for the overseas trade to England lay to the westward of the Island Empire. The routes to the operating zone from the North Sea bases were therefore very time-consuming for the German submarines. Out of the three to four weeks in which a submarine stationed at Helgoland was at sea, about two weeks of this time was consumed in going to and returning from station. The longer the period of the individual undertaking of the submarine, the longer the corresponding overhaul period required by the delicate, easily worn machinery installation. Of approximately sixty submarines which were in service at the North Sea bases during the summer of 1917, there were on the average only twenty-three at sea at one time, the others being under overhaul in the dockyards.

Of these twenty-three boats only about one-third of the number were actually in operating areas. The unfavorable strategic situation in regard to England is shown very clearly by these figures. In this connection the location of the bases in Flanders and in the Mediterranean was far more favorable; a fact which contributed largely to the greater measure of success obtained by the smaller number of boats operating in those zones. To this should be added the fact that long cruises and the necessity for keeping at sea for correspondingly long periods demand submarines of the larger type. The long period of construction of this type of submarine makes it difficult to keep the number up to the normal requirements.

However, the number of boats available, as shown by the foregoing, plays a very important part in the effectiveness of the submarines; the more so, the further the operating zone is distant from the base.

When we summarize the results of the submarine commerce warfare throughout the entire war, without going into the disputed question regarding the total amount of ship tonnage actually sunk, according to all the evidence now available, it may be stated that the submarine warfare, in spite of Germany's unfavorable strategic situation and in spite of the energetic anti-submarine offensive, came very close to exhausting England's resources.

This was not due alone to the loss of shipping and the valuable cargoes of munitions which were sunk, but also to the holding in check of other war strength as a result of the submarine warfare. Some figures will illustrate. About 13,000 guns of medium and light caliber were mounted for the arming of the English merchantmen; while it is estimated that about 65,000 men were required for the service of the guns. For the mine-sweeping operations in 1917, 3,200 English craft with a personnel of 25,000 men were kept in service. The munitions required, for the service of the batteries on the English merchant ships and auxiliary vessels, as well as the quantities of explosives required by England during the war for torpedoes, depth charges and mines, amounted to about 46,000 tons, according to conservative estimates. This is equivalent to the total output of one of the largest German munition factories for a period of one whole year. In Germany the total personnel required for the manning, overhaul, repair, and replacement building of submarines and at the dockyards amounted

to 112,000 men; in England, there were required for the manning, overhaul, supply, and replacement of patrol vessels as well as for the construction of vessels to replace losses by sinking, 770,000 men. In all, 112,000 against 770,000 men. This entire strength of personnel as well as the large quantities of war material would have been available to England for the conduct of the war on land had Germany not inaugurated the submarine campaign. On the German submarines at the front during the war there were, according to the most careful estimates, about 13,000 men in all. Of these, 5,087 were killed. As opposed to this relatively large loss in personnel, which, however, was really very small when compared to the great losses sustained elsewhere in the war, there stand: first, the sinking of shipping tonnage almost equal to the entire British merchant tonnage before the war; and further, the diversion of other enemy war strength. With a sacrifice of 5,087 combatants, 770,000 men were held in check.

The question as to whether the German submarine warfare might have led to success and under what conditions this would have been possible lies outside the scope of this article. Suffice it to state here, that the attack of the German submarines on the overseas shipping and imports of their most dangerous enemy, as well as the effect of this campaign on the auxiliaries and fighting strength of the Allies, came very close to paralyzing them decisively. The possibility of success and the vulnerability of England have been proven. As long as submarines exist they will continue to be a threat to those nations which are unconditionally forced to rely upon overseas transportation. The study of the causes of the failure of the German submarine campaign will be of interest to certain nations in their preparations for war against certain possible enemies; but likewise the problem must be studied as to the extent to which the sources of Germany's strength are available in their own country. A glance at the chart shows that the war harbors of France in relation to England are far more favorably situated than those of Germany. The time required for approach would be short, while there would be no narrow straits of Dover to pass. Further, for those countries bordering on the Mediterranean, there would be favorable strategic bases for submarine operations against any possible enemy. With these geographic relations of the European countries, the number and type of submarines employed by Germany during the war, may well

be used as a basis of consideration by other navies. With either the Atlantic or the Pacific Ocean with their much larger dimentions under consideration as a theater of war, a greater number of submarines of the larger type come into consideration; boats having a large radius of action and good sea-keeping qualities. The larger submarine types, however, require long periods of construction with high costs; while the rapid increase of the number of such submarines in time of war would present a very difficult problem. The establishment of a base in the vicinity of the zone of submarine operations would then probably be the best solution of the strategic problem. That the technical qualities of the boat, its complement and command should be equal to the most exacting demands of the service, is essential for any vessel in war opposed to a powerful enemy, but for the submarine service these conditions must be especially emphasized. But to an even greater extent must be noted here the necessity for a large number of submarines. The restricted zone of tactical effectiveness of the individual submerged submarine, the long period of overhaul essential after every undertaking, the losses suffered as a result of an energetic anti-submarine offensive, all combine to make the number of submarines of the greatest importance. That the capacity of the submarine bases should be adequate and the machinery installation of the boats reliable, goes without saying. But no navy will be in the position of having as many submarine flotillas in service in time of peace as will be required for war. Therefore, a rapid increase in the number of submarines after the outbreak of the war will be of decisive importance in the event of a protracted war. One of the necessary conditions for this, if the state is to be able to meet the requirements of a large scale submarine offensive, is the possession of an adequate foundation in material and personnel which may be drawn upon for the creation of boats of fighting effectiveness for service at the front.

The subject matter contained in the last few paragraphs dealing with the submarine commerce warfare of the German submarines during the war also applies to the purely military employment of these boats during the war, the only exception in that case being that in judging the strategic situation the relations were not so unfavorable for the German submarines. With regard to the radius of action of the submarines the distances were limited by the North Sea; the war zone under consideration. The course of

the British naval forces, when operating against the German Bight, or better, when they put to sea to make contact on the report of the German Fleet standing out, was on the whole predetermined by the conditions. Thus the direction of attack for the German submarines was fixed from the start. If we compare this strategic situation with war conditions in the Pacific Ocean and consider the immense distances which then come into play, one can realize that the strategic conditions for the German submarines were not exceptionally difficult.

But in only two periods of the World War were the German submarines available for strictly military service in the naval warfare to any appreciable extent—from the beginning of the war until the first initiation of the commerce warfare in 1915, and in the summer of 1916 when the submarine commerce warfare around the waters of England was discontinued. On closer examination it will be noted that the methods of employment of the submarines in these two periods were fundamentally different. In the operations of 1914-15 the mission of the submarine was to act singly in attacking possible enemy vessels in certain definite operating areas, or to lie in wait for such craft in the vicinity of one of the enemy harbors. On the other hand, the plan of submarine operations in 1916 was based on the idea of bringing groups of submarines into position to attack the enemy main body in joint operations with the fleet.

In the first period the following successes were attained as a result of the individual operations of the boats; September, 1914, *U-21* sank the English light cruiser *Pathfinder* near the Firth of Forth, *U-9* sank the armored cruisers *Cressy, Hogue,* and *Aboukir* in the southern North Sea; October, 1914, *U-9* sank the cruiser *Hawke* in the northern North Sea; *U-27,* the aircraft carrier *Hermes* near Calais; *U-21,* the gunboat *Niger* near the Downs; December, 1914, *U-24* sank the English battleship *Formidable* in the English Channel; June, 1915, the *U-38* damaged the cruiser *Roxburgh* by a torpedo hit in the northern North Sea.

In order properly to evaluate the plan of operations which led to these successes, due consideration must be given the strength of forces employed. The above mentioned successful undertakings were only a few of the many which were conducted by the German submarines during that period without result. At that time German submarines were engaged in practically uninterrupted

cruises in the North Sea seeking opportunities for attack. By far the greater part of these boats were not favored by luck, and many did not even sight a single unit of the enemy forces. Many were forced to return to their bases owing to inclement weather or owing to irreparable damage to the machinery installations; many only sighted enemy vessels in the distance and could not approach to within torpedo range on account of the low submerged speed of the boat, while others missed with their torpedo shots when an alert enemy sighted the torpedo track and sheered out. All in all, to obtain a slight result a great expenditure of force was necessary; the principle involved was unquestionably not rational. And what was the final effect of such German submarine activities on the general situation of the war at sea? After the sensational success of the *U-9* in September, 1914, even some of the experts were prone to overshoot the mark in their conclusions, and were inclined to the opinion that the supremacy of the battleship had been placed in question by the submarine. This, however, was in no wise the case. The command of the sea held by the British naval forces, the fighting strength of which was embodied in their battleships, was in no way fundamentally disturbed. The overseas trade of Germany remained throttled as before. But still something notable was achieved by the German submarines. The British naval forces which were assigned to the task of patrolling the North Sea were forced to remain at a respectful distance from the German coast. Even in the northern North Sea, and later, in the waters to the westward of Great Britain, and finally in the bases themselves, the English naval forces were for some time in a state of insecurity. No one describes this more vividly than Admiral Jellicoe himself in his book entitled *The Grand Fleet; 1914 to 1916*. Those vessels which were at sea were forced to steam at high speed with constantly changing course and to consume much extra fuel at the expense of their sea-keeping qualities, while the personnel on the bridge, at the boilers and in the machinery spaces were subjected to continuous strain. The protection of the vessels at sea and the patrol of the coastal waters necessitated the employment of an enormous number of small, fast sea-going convoy and patrol vessels. From all this the German naval command profited to the extent that practically the entire North Sea, aside from a few English raids, was free from all large enemy warcraft. The British operations against the German coast and the island of

Helgoland, which were seriously discussed and advocated by the British Admiralty, were not attempted, and the fact that the route was clear for a German raid on the east coast of England, must be attributed to a large extent to the influence of the German submarines.

Still another strategic advantage, which was not apparent to the outsider, was obtained by the German naval command as a result of the submarine operations. They were constantly informed as to the disposition of the North Sea patrol forces as a result of the continuous reports of the submarines at sea, and were thus enabled to obtain the essential oversight and estimate of the situation in certain areas when planning particular operations. Thus the submarines acted as far advanced scouts in furnishing definite strategic information to supplement the relatively weak air reconnaissance; independent of their own command of the sea. With the increasing range of the radio installations of the submarines during the war the radius of this distant scouting became greater. This range was finally extended far beyond the limits of the North Sea and may be taken into important consideration in theaters of war even more extended than those which come into consideration in a European war.

But in spite of the achievements of the submarines in the early part of the war—which are not to be underestimated, and in spite of their strategic effectiveness in extending the coast defenses, it must be repeated that the individual submarine operations in the first two years of the war produced few results as an offensive, while the method of employment was very uneconomical. There was a great expenditure of strength, considerable useless strain on both personnel and material, the opportunities for attack in the open sea were exceedingly small and a matter of pure chance, and the activities in the vicinity of the enemy coast were made extraordinarily difficult as a result of the enemy counter-offensive. Therefore there was no appreciable equalization of the fighting strength of the fleets brought about by the submarine operations in preparation for a decisive fleet engagement. In the nature of things such a result cannot be expected of the submarines.

These considerations led the German fleet commander in the summer of 1916 to another plan of submarine operations. The attempt was then made to assemble the submarines in a certain area over which the enemy would in all probability be forced to

pass, or to entice the enemy by movements of the German fleet to pass a position to which the submarines had been opportunely directed. The details of the primary plan were as follows—when the appearance of the German fleet in the North Sea had been reported, the main body of the British fleet would stand out to sea from their bases. If the fleets made contact then the damaged vessels would return to their bases under much reduced maneuvering power. During the period when the enemy ships were standing in and out of their harbors, which could be fairly closely determined, the large number of German submarines near these harbors must certainly find opportunities for attack. Thus there would be no long period of waiting or searching for vessels to attack but a concentration of a number of boats in a favorable position for attack in order to compensate for limited range of visibility and area of operations of the individual submerged boats. Such a plan was prepared toward the end of May, 1916, for joint operations of the submarines in connection with the Battle of Jutland—it ended, however, in a failure. From May 23, 1916, on, the submarines in the North Sea available for service lay in the vicinity of the English war harbors, ten near the Firth of Forth, and Pentland Forth, and two near the Humber, with orders to remain on station until the evening of June 1. The German fleet, however, was forced to postpone the operations planned for May 23 until the end of the month for reasons of the gravest importance. When on May 30 the decision was made to stand out, the commander-in-chief of the German fleet directed that a radio be dispatched ordering the submarines to remain on station one day longer. But this order was received promptly only by a very few of the submarines; and either too late or not at all by the majority of the boats, since they were stationed very close in to the enemy coast and were forced to remain under water for a great part of the time by the enemy patrols and were therefore deprived of radio communication. Practically all of these boats were exhausted as a result of being held for eight days on station in the immediate vicinity of the enemy patrols. The English fleet left its anchorage at midnight May 30-31 and thus passed the position of the majority of the German submarines during the hours of darkness without being sighted. Only two boats, which had meanwhile shifted position to a greater distance from the English coast, sighted parts of the English force, standing out at daylight on May

31. These two submarines, which were surprised by the enemy suddenly coming in sight out of the mists, were unable to make a successful attack. Thus it occurred that the majority of the submarines remained in ignorance of the battle which took place on May 31 and June 1, and had already left their stations at the most favorable moment when the English fleet was returning to its bases after the battle. It was purely accidental, then, that in spite of this, on June 1, a submarine encountered each of the damaged battleships, *Marlborough* and *Warspite,* which were returning unescorted to port. Two misses in the heavy sea, again proved the limited value of a submarine acting singly against a freely maneuvering, alert enemy. Thus this first undertaking of the submarines operating in conjunction with the fleet at the Battle of Jutland proved a failure.

However, one cannot say that the underlying principle planned in these operations was necessarily a failure. The lack of success must rather be attributed to the manner in which the boats were disposed and the resulting lack of possibility of communication. It was shown by these operations that the premature disposal of the boats close under the enemy coast and within the effective zone of activities of the enemy patrols was a mistake. The submarines are thereby forced under water during the daylight hours, radio communication is interrupted, and the crew is tired out and unable to obtain the necessary relaxation even when the boat comes to the surface to re-charge batteries at night. Further, if the enemy fleet happens to be already at sea before own fleet operations commence, then such waiting in the first period, before the battle, is necessarily a delusion.

On August 19, 1916, an advance of the German high seas fleet toward Sunderland, on the east coast of England gave an opportunity for a practical application of the submarine experience obtained during the Battle of Jutland and for developing the submarine operations in conjunction with the fleet one step further. This time the initial position of the boats was in the form of movable lines, which although based on the coast, still extended well out into the open sea, disposed in such a manner that the enemy standing out from either the harbors to the northward or southward would in all probability have to pass over one of these lines of submarines. In general these boats could remain on the surface in readiness to receive orders transmitted by radio. The

commander of submarine forces was embarked on one of the battleships of the High Seas Fleet and was able as a result of reports received from the airships and some of the submarines themselves to direct the line of submarines in the direction of the reported enemy main body by means of radio instructions in accordance with the prearranged plan. All radio messages in this connection were correctly received by the submarines and fulfilled their purpose of directing the submarines toward the enemy course. One of these submarine lines comprising six boats was stationed initially in the latitude of Sunderland while another comprising four boats was in position directly across the mouth of the Humber. The calculations of the German commander-in-chief proved correct. Of the ten submarines, six were able to sight the enemy and five were enabled to fire torpedoes. Of the twenty torpedoes fired on August 19 and 20 by the submarines, eight were hits. The cruisers *Nottingham* and *Falmouth* as well as one destroyer were sunk in spite of their high speed, strong escort, and depth charge offensive; further a hit on one of the battleships was reported as certain by one of the submarine commanders, but so far as known, was not conceded by the British.

The great effectiveness of the German submarines on that day was again vividly portrayed in the previously mentioned book of Admiral Jellicoe. His impressions and the conclusions which he has drawn from this attack are cited in the following extracts from that work:

> The numerous submarines already sighted made it probable that the trap was extensive; it was therefore unwise to pass over the water which he had occupied, unless there was a prospect of bringing the high seas fleet to action. . . . . During the passage up the searched channel a number of submarines were sighted and frequent, and in some cases, *large alterations of course* were necessary to avoid them; if all the reports were correct, the locality indeed seemed to be a hot-bed of submarines. . . . . The experience of August 19 showed that the light cruisers, proceeding at even the highest speed unscreened by destroyers, ran considerable danger from enemy submarines. . . . . Representations were made to the Admiralty to the effect that it was considered that in the future light cruisers should be screened by at least one destroyer per ship. . . . . The ease with which the enemy could lay a submarine trap for the fleet had been demonstrated on August 19. . . . . It was clear that it was unwise to take the fleet far into southern waters unless an adequate destroyer force was present to act as a submarine screen for all ships. . . . . If the circumstances were exceptional and the need pressing, it would be necessary to accept the risk.

There was general agreement on this point between the flag officers and the Admiralty.

A far-reaching and significant estimate of the submarines and their effectiveness.

No contact was made by the two fleets on August 19, 1916, since the German fleet was diverted to the southward by the report of an airship stating that strong enemy forces had been sighted to the southward of the German line of advance, although in reality the English main body was approaching from the northward. Thus on this occasion no opportunity offered for actually determining the prospects of success of a line of submarines during the deployment of the battleships for action and shortly after the action, when their movements were controlled by radio from a single station.

In this action it was not intended that the submarines should be drawn into action during the main engagement, any more than at the Battle of Jutland; it being correctly held that the submarines were not suited for employment in this manner.

Further joint operations of the German submarines and the battle fleet did not take place during the war, since after the beginning of 1917 the submarines were employed uninterruptedly in commerce warfare. Thus the chapter on the purely military employment of the submarines was prematurely brought to a close. But even these few actions suffice to show clearly what value may be attached to the submarines when engaged in strictly military operations in naval warfare. These gave the naval warfare in the North Sea a definite trend; the superior English fleet was held at a distance, and to a great extent they thus assisted in the protection of the German coast, while at the same time providing freedom of action for the German naval forces. In the same sense in which we speak of a "fleet in being," a fleet which exerts its effectiveness merely by its presence, so we can apply this idea to the submarine weapon. The enemy is restricted to a certain extent, since at any time this weapon may threaten a certain position. It is also correct to designate the submarine as an essential defensive weapon of the weaker power. Although it may be pointed out that the coast of Flanders was repeatedly bombarded by the British monitors in spite of the presence of the German submarines stationed there, it should be noted that these waters possessed very exceptional navigational conditions and that the moni-

tors were able to seek protection among the numerous sand shoals which made submerged maneuvering on the part of the submarines a practical impossibility. One need only recall the appearance of the German submarine *U-21* off the Dardanelles toward the end of May, 1915, to realize the great effectiveness of a single submarine against a strong force engaged in bombarding the coast. However, it must be emphasized that a single submarine will in general not suffice for coast defense. There must be means at hand to keep open a passage for the submarines to stand out, against enemy efforts to block such channels. In those localities where nature has not provided favorable coastal formations and great depths of water, the support of a strong, effective fleet will be essential to the submarines.

With regard to the offensive employment of the submarines, one frequently hears the statement that they can only be used for attack in commerce warfare and in the rôle of "pirates." However, he who reads the conclusions of the British commander-in-chief quoted above pertaining to the action of the German submarines on August 19, 1916, will be of another opinion. To this should be added only that the methods of employing submarines as an auxiliary in naval warfare have not been developed to the highest state of perfection. As stated before only two engagements took place and in both only a relatively small number of submarines participated. Valuable experience was obtained from these. However they cannot longer be applied in actual warfare. The careful training in the cooperation of all branches of the service, which is as important to naval warfare as to war on land, was not carried through to its final conclusion in the case of the submarines. This cooperation of the submarines is of particular importance since the inadequacy of the submarine acting singly was thoroughly demonstrated. So much is certain; the high state of the technical development of the modern submarine offers a wide field of activity for the offensive employment of the submarines along the lines indicated.

One final question now remains to be considered—what does the technical development of the future offer for the submarine? Are we on the threshold of undreamed possibilities for this weapon which was developed into such a surprisingly important factor during the World War? Is the submersible of the future to force naval warfare to assume other forms and possibly to

displace the battleship in its present day supremacy on the seas?

With regard to technical developments one must guard against any prophecy for the distant future. What is stated in regard to the questions above propounded can only be applicable to the near future and only in so far as may be indicated by the trend of present developments. Without doubt, the beginning of this development is to be found in the increase of displacement, to which most of the important navies of the world are already committed in their new construction, since the conclusion of the war. This decision was largely due to the desire to increase the effectiveness of the submarine corresponding to the war-proven importance of this weapon, to strengthen it in every respect and to make it suitable for employment in widely extended theaters of war by means of increased sea-keeping qualities and radius of action. But it appears further, that an increase in displacement will not only result in an increased radius of action, but with proper discernment will also lead to greater effectiveness from both a strategic and tactical standpoint; as well for strictly military operations of the submarines as for commerce warfare, on occasion.

The principal objection raised in the past to the employment of the submarine as a weapon in commerce warfare was that the submarine was not in a position to safeguard the lives of the passengers and crew before sinking a large merchant vessel. With regard to the submarine as it existed during the World War this is, of course, an undisputed fact. However, a new prospective is opened up by the submarine cruiser of over 3,000 tons. Under these circumstances the question might then be re-opened by those who are interested in this procedure. It is probably now possible to construct a submarine cruiser in such a manner that the passengers and crew of a large steamer might be temporarily accommodated on board, and the cruiser would thus be in the position to conduct commerce warfare in the same manner as surface cruisers during the World War and in former times; in accordance with the "Rules for Prizes." By means of such submarine cruisers the commerce war would then be conducted on the high seas, beyond the point where the danger from mines and small patrol vessels with their threat to the submarine could be extended. Airplanes carried by the submarine will still further extend the range of effective visibility. Heavy armor and a strong armament will further serve to make such a submarine cruiser a dangerous opponent

for a protected convoy and it will be enabled to combat successfully all offensive measures which were employed against the German submarines during the war. The submarine cruiser will certainly be far superior to any other special type of craft as a privateer owing to its great radius of action and also its possibility of withdrawing from a superior force by submerging. Such a craft will be difficult to annihilate.

Increase of displacement may also be utilized to increase the speed of the submarine. An increase in speed of the submarines was already achieved toward the end of 1918 by improvements in the machinery installation as a result of further developments in the technique of motor construction without involving increased weight. If it is possible to increase the speed of the submarines to a point where they are enabled to accompany the fleet—and this appears to be about the limit of the future possibilities—then the joint tactical operations of the submarines and fleet may be further perfected.

The operations of the submarines with the fleet as described on August 19, 1916, must be designated as primitive. The greater the speed of the submarine, the closer the tactical cooperation with the fleet during the approach and the easier it will be to direct the submarines to favorable tactical positions for attack after the enemy has been reported. Further, the perfection of the underwater signalling devices promises to be advantageous in this connection. In practice the expert will be confronted by other problems, one of which will probably be the still unsolved question of the German submarine cruisers; the proper seaman-like handling of the large submarine in a heavy sea. In this article, we can only indicate the theoretical lines of possible development which may result from further technical improvements.

Like all implements of warfare, the submarine will be further perfected from both a technical and military standpoint; its field of activity will be increased, and it will become a more effective weapon in naval warfare.

New methods will be developed to combat the submarine and the methods of conducting naval warfare will change to meet the situation created by this new weapon. With all of the above, so far as one can conceive, there is nothing radically new, nothing which is calculated to revolutionize the present concepts of naval warfare that mankind may imagine. Above all there are two

sources of weakness which appear to be inseparably connected with the nature of the submarine—the fact that the submarine must carry a double-machinery installation, for surface and for submerged cruising, as well as the restrictions imposed on the submerged submarine in speed, radius of action, and range of visibility. The technical problems involved appear to be incapable of solution at present. Meanwhile, the inferiority of the submarine as against an equally large surface vessel—all in all, type for type—will remain. None of the other types of vessels developed for naval warfare will be reduced in effectiveness as a result of the submarine development, or radically influenced in its field of application.

As before, the battleship will remain supreme in war on the sea.

Still less, however, have the anti-submarine measures developed during the war succeeded in causing the submarine to be displaced. All indications point to the fact that this type will increase in value for naval warfare if its further development is not forcibly stopped by other means.

AIR TACTICS AND STRATEGY

By Lieutenant Forrest Sherman, U. S. Navy

"My aeroplane is nothing but a flying gun"—Georges Guynemer

DURING the recent hearings before the President's aircraft board witnesses were frequently asked whether or not they recognized air tactics as something quite separate from naval tactics or sea tactics and also air strategy as something distinct from land and sea strategy. The question was answered in almost as many ways as there were witnesses depending upon the witness' interpretation of the question and its bearing upon other matters under discussion.

The use of airplanes has indeed introduced a third dimension into warfare and the influence of the airplane in this respect has made itself felt on land and sea and has had a marked effect on the detailed application of tactical principles to the uses of various types of military and naval units. If the introduction of airplanes has given rise to new tactical principles we can easily agree that the tactics of the air is something new and separate. If we find that the art of fighting in the air includes no new tactical principles but merely slightly different applications of the old truths to the new material it will be evident that air tactics differ from land and sea tactics only as minor tactics, just as artillery tactics differ from infantry tactics and destroyer tactics from submarine tactics. In the same way we can agree on the existence of air strategy as distinct from maritime and military strategy if, and only if, we can find new and different strategic principles involved.

What, then, are the proven principles? Exactly what do the terms strategy and tactics mean in the question at issue? Strategy is the art of using the armed, economic, and political forces of a nation to achieve a national object. Military strategy is the art of bringing military forces to battle; maritime strategy the art of bringing naval forces to battle, or more broadly the art of using naval forces to secure control of the sea with or without battle. Tactics is the art of using armed forces in battle to defeat enemy armed forces, military tactics in the case of the land battle, naval

tactics in the case of the sea battle, and air tactics in the case of battles in the air.

The principles of war have been studied and used by the great leaders in all times; some of them have been definitely named and explained by the same leaders, others have not. They can, however, all be deduced by a study of the achievements of those masters of the art of war who have in the past achieved victory by land, sea, and air. One cannot study the campaigns of Napoleon, Wellington, Lee, Jackson, von Moltke, Nelson, and Suffren, or the combats of Richthofen, Fonck, and of Guynemer without becoming conscious of certain principles underlying all warfare, principles applicable to both strategy and tactics. In the words of Napoleon, "the principles of war are those which have guided the great leaders whose achievements have been handed down to us by history."

Marshal Foch in his volume entitled *The Principles of War* explains the principles of freedom of action, free disposal of power, protection, economy of forces, preparation, mass, impulsion, surprise, and of initiative. Another great leader has expressed the fundamental principle as superiority at the point of contact, and yet another the principle of cooperation.

These principles have been ably classified, and in some cases renamed, as the principles of superiority, surprise, simplicity, security, economy of force, movement, cooperation, the offensive, and the objective. If in an examination of the methods used in air warfare we can find additional fundamental principles we shall have discovered a fundamental difference between air tactics and strategy and military and naval tactics and strategy.

On July 19, 1915, Corporal Guynemer flying a Nieuport biplane machine armed with one flexible machine gun overhauled a German biplane Aviatik over Coucy at 12,000 feet altitude. Guynemer dove and placed himself some fifty yards behind, under, and to the left of the Aviatik, his observer opening fire with his machine gun. After a short burst which took effect in the fuselage of the German plane, his gun jammed. While clearing the jam, a German bullet grazed the observer's head and hand, but the second burst of fire from the Nieuport killed the German pilot and the German machine fell in flames. This was the first victory of Georges Guynemer, later captain, officer of the Legion of Honor, and victor of fifty-three combats in slightly over two years. It was

won by the proper application of the principles of surprise, offensive, and of superiority at the point of contact—the blind angle of the German gunner—and not by any hitherto unknown tactical principles.

On September 23, 1916, Guynemer sighted a group of five Fokkers flying three in line above and two below engaged in attacking another Frenchman. Guynemer dove at the trio. At 11:20 one fell in flames as Guynemer pulled up and attacked again causing the second to dive away thirty seconds later to a forced landing with observer killed and pilot wounded. At 11:23 the third pilot, the only one who ever saw his assailant, was falling in flames. Almost immediately Guynemer's left wing was carried away by French anti-aircraft fire, and he crashed to earth with minor injuries. This battle was won by the same indomitable spirit of the offensive which carried the miraculous Guynemer through his fifty-three victories coupled with the completely successful use of surprise. On January 26, 1917, the same Guynemer with gun jammed beyond clearing brought his thirtieth German plane down within the French lines, with its occupant unhurt, by repeatedly diving through bursts of fire at a biplace Albatross until its pilot and observer gave up the fight, and thus proved for all time his bravery, determination, and will to conquer—the spirit of the offensive to an exalted degree.

On September 30, 1917, Captain Weissmann, who had killed Guynemer on September 11, 1917, met Lieutenant René Fonck at 24,000 feet. Weissmann was flying a biplace Rumpler and Fonck a monoplace Spad. The remainder of Fonck's patrol was some 3,000 feet below. Fonck went into a climbing turn and maneuvered for a position from which he could attack with his single fixed gun without encountering the superior fire of the Rumpler's fixed and free guns. Soon the position was attained and a sudden reversement followed by a zoom up under the tail of the Rumpler enabled him to secure victory with a short burst of six rounds. Thus victory was won by utilizing the superior maneuvering power of the Spad to apply the principle of movement and achieve superiority at the point of contact in spite of the superior gunpower of the Rumpler.

With the inauguration of formation fighting by Captain Boelke and von Richthofen, a tactical principle new to air fighting was introduced: the time honored principle of cooperation in order to

achieve superiority at the point of contact. Richthofen's squadron flying and fighting in formation downed 194 allied airplanes in six months and forced formation tactics on the allies.

It was proven many times during the World War that the principle of the offensive was most important in air warfare, that the best defense against aircraft is to attack the enemy air force from the air, destroy his planes, his hangars, and his supply bases. In July, 1918, the allied forces in certain sectors were operating their aircraft in a system of defensive patrols which, since they were continuous, were of limited strength. The Germans soon commenced operating at irregular intervals in greater strength and the allied losses were terrific. Again we see the application of the ancient tactical principle of superiority of force at the point of contact. The situation was relieved only when allied offensive aviation was made available from other sectors to conduct continued bombing raids against German communications and supply bases and thus put their air units on the defensive.

In September, 1918, an American bombing flight was despatched to bomb Mars-la-Tour in cloudy weather which forced the bombers to fly at low altitudes under heavy clouds. Pursuit protection was absent, supposedly due to failure to rendezvous in the existing bad weather. This failure or neglect caused the bombing flight to arrive over Conflans, where it released its bombs, in the face of a spirited attack by the German pursuit aviation. For a period of twenty minutes during which no friendly pursuit planes were sighted the bombers fled southwest before the German pursuit planes, one squadron of which attacked from below, one from above, and one from ahead. The American squadron suffered terrific losses which were reported by the Chief of Air Service of the First Army as thirteen airplanes out of eighteen. This attack, which can best be compared with the attack of a capital ship unit alone against overwhelming fire from shore batteries supported by torpedo flotillas, illustrated clearly the penalty of disregarding fundamental tactical principles: the principle of security—there being no pursuit escort or screen; the principle of cooperation—the failure to rendezvous; the principle of superiority—attacking in the face of overwhelming gunpower, and the principle of the objective—the bombing of the wrong point.

At the end of the battle with the Spanish Armada, Lord Howard reported: "Though our powder and shot were well nigh spent

we put on a brag countenance and gave them chase, as though we had wanted nothing." After his famous combat of January 26, 1917, Guynemer said: "In any case it proves, my dear captain, that it is better to work with your head than with the most highly perfected machine gun." Were not Howard and Guynemer following the same principle of war? Is not Guynemer's attack on three enemy planes on September 23, 1916, almost directly comparable to Jervis' attack on twenty-seven line of battleships with fifteen at St. Vincent? Was not the failure of the pursuit aviators to make contact during the Conflans raid until twenty minutes after the fight had started somewhat comparable to the famous twelve mile error at Jutland?

The major weapon of the battleship is the heavy gun and as a result we find the minor tactics of a battleship to be those which will best develop its gunfire. As gun ranges and mountings change, battleship tactics change—gunnery and tactics go hand in hand. The principal armament of the fighting (pursuit) plane is also the gun, and we find that fighting plane tactics are also absolutely dependent on gunnery. The desire to develop a concentration of gunfire at equal ranges causes the battle formation of battleships to be a line of bearing of units normal to the enemy direction. The same consideration, the desire to develop a concentration of fire on a common objective, causes the battle approach formation of fighting planes to be a line of bearing of units normal to the enemy direction. The desire to lay down an efficient torpedo salvo causes destroyers to attack on certain bearings and in close concentration. The same desire will cause torpedo planes to attack in a similar way since the principles of torpedo fire are the same regardless of the nature of the torpedo craft.

The moment that we realize that the underlying principles of war as proven in the past govern air warfare as well as war on land and sea, a great deal of the obscurity surrounding air tactics and air strategy disappears and we find ourselves able to prepare for the future in the light of the past. In the records of the fighting at Jutland can be found lessons of the greatest value to air scouting squadrons; examples of valuable information reports from able light force commanders such as Commodore Goodenough, and examples of useless information reports as well. There is a lesson for torpedoplane squadrons in the successes and failures scored by the German and British torpedocraft in the

same battle. Stonewall Jackson's maxim, "Always mystify, mislead, and surprise the enemy," is just as valuable advice for the student of fighting plane tactics as for the infantryman. It must be realized that war is, after all, a matter not only of weapons and resources but of men, of human nature, of flesh and blood.

Other elements vital to the success of war in the air as much if not more than to the success of war on the surface are organization, training, and discipline. By discipline is meant not only subordination to superior authority but that intellectual discipline which enables a subordinate leader to understand the thought and purposes of his superior, interpret them in the light of the local circumstances with which he is confronted, and take such action as will best fulfill those purposes. A most successful instructor in aerial fighting tactics included in his orders to his students the following: "Full cooperation, which is the essence of the aerial fighting doctrine, can be achieved only by clear thinking." He might well have added that full cooperation could not be achieved without loyalty and confidence between superiors and subordinates.

Discipline in action on the ground or on board ship is maintained by personal contact, the presence of comrades, the direct personal influence of a superior, and adequate communications. Air discipline can be insured only by the development of loyalty and indoctrination. A fighting plane pilot flying at four miles above the surface of the earth has little or no sense of physical contact with his fellows. Who knows whether he fights or avoids battle—no one but himself.

Aviation can be classified as offensive aviation and auxiliary aviation. Offensive aviation is that branch of aviation which is organized, equipped, and trained to destroy enemy armed forces from the air. It includes fighting units—monoplace and biplace fighters, attack units—torpedo planes and bombers, and information units—scouting planes. Auxiliary aviation is that branch of aviation which is organized, equipped, and trained to serve surface units.

The tactical organization of the offensive aviation of a fleet—the air force as distinguished from air service—must provide for the massing of sufficient fighting strength to meet and break up the enemy fighting strength. If the enemy fighting strength is not met and destroyed, attack, information, and auxiliary units will be faced with the necessity of performing their respective missions

in the face of enemy fire, which will be extremely difficult to accomplishment. Supremacy or control of the air is essential to the successful employment of fire control aircraft and must, therefore, be obtained if the capital ship units are not to be seriously handicapped in their struggle on the surface.

The comparatively limited number of fighting aircraft available will always make it imperative to keep the assignment of fighting units to defensive rôles, such as the protection of observation, bombing, or torpedo flights, to a minimum. A tactical organization which assigns any appreciable percentage of fleet air fighting strength to the definite task of protecting or "screening," spotting, torpedo or bombing planes before air supremacy is gained, directly violates the principle of mass, the principle of superiority at the point of contact, and the principle of the offensive. To divert and dissipate air fighting strength in small flights, one to each observation and attack flight, one to attack enemy observation craft, and one to defend the battle line against hostile aircraft, is to invite disaster. Attack and observation units are by no means unprotected when a massed fighting plane offensive is being vigorously directed against the enemy fighting strength. On the contrary they are receiving protection of the highest order. The surest way to insure defeat in the air is to disperse fighting strength in purely defensive rôles.

In air fighting the offensive wins and a vigorous offense is the only defense. The essentially offensive nature of successful fighting tactics is apparent when one considers that a single seater fighter has guns firing straight ahead only. To shoot at all, the plane must be flying toward the enemy at terrific speed, and effective range is not over 200 yards. Victories in the air are won by only one thing—fighting.

Napoleon said, in discussing his Austrian campaigns:

> They have many good generals, but they try to see, to keep an eye on too many things; they try to see, to keep, to defend everything: depots, lines of communications, the rear, such and such a strong position, etc. Using such methods, they end by adopting, when on the defensive, the cordon system; when on the offensive, they end by attacking in several directions, or rather in conducting several attacks at the same time; in the one case, as in the other, they end in dispersion, which prevents them from commanding, from combining one single affair, from striking hard; they end in impotence.
>
> . . . . I see only one thing, the *mass;* I try to destroy it, feeling sure that the accessories will then tumble down of themselves.

To destroy the enemy massed fighting strength we must organize and train our own units to fight as masses. The day of free lance fighting pilots, of individual aces, has passed.

In this connection it may be stated that the dispersion of fighting planes among the battleships, one or two to a unit, to be incorporated in the ship's organization, seems unjustifiable on tactical grounds. It is, of course, absolutely justifiable as long as battleships are the only carriers available for the fighting planes involved. If other carriers are not available, battleships should carry fighting planes to their utmost capacity. However, as long as the tactical organization of fighting planes is by three plane sections and nine plane divisions, it would seem expedient to distribute them among the larger combatant ships on that basis if at all. Observation aircraft are very properly considered part of the battleship gunnery organization and should be included in ship organization. One fails to comprehend just what part a fighting plane can play in the organization of an individual battleship.

The massing of fighting strength does not require flying in unwieldy formations. On the contrary it requires tactical formations which comply with the requirements of gunnery, which are simple, compact, flexible, and maneuverable. Units must be small enough to maneuver rapidly and freely, far enough apart so that they do not impede each other's maneuvers, and close enough for mutual support. Each plane and unit of planes must have sufficient freedom of movement to develop its gunfire rapidly. Within the above limitations they must be massed as closely as possible.

A large fighting formation must provide for developing the fire of its units in such a way as to maintain a continuous fire against the enemy formation. It must, therefore, have sufficient depth to allow for a succession of attacking planes, thus enabling the first planes to fire, pull up, and return again in their turn, making the attack continuous and controlled. If this is not accomplished the fighting will degenerate into a melée, a so-called "dog fight," or rather a number of individual "dog fights," units will get out of control, and the organization will become a mob. The front of the formation, that is the number of planes in the first attack wave which fire simultaneously or nearly so, is dependent on the size and nature of the force engaged, the size of the formation itself, and the relative direction from which the attack is launched. The

depth of the formation is dependent on the total number of planes available and the necessary front. When operating on the defensive, for instance when screening a spotting or attack flight against a superior force, a maximum front is required. On the other hand a mission which requires fighters to break through an enemy formation in order to attack spotters, torpedo or bombing planes requires a maximum depth of formation in order to increase the shock effect of mass and thus insure breaking through.

Considerations outside the struggle for air supremacy itself may render it imperative to detach air fighting units from the main offensive. In the case of two fleets in action at long ranges where main battery fire is made possible by air spotting, it will often be not only advisable but necessary to detach a considerable portion of the fighting strength to attack the enemy spotting flights in order to avoid a disaster to surface ships. Such a detachment will probably result in causing a diversion of enemy fighting strength and may result in a combat which will grow to large proportions, involve the major fighting strength of both sides, and become decisive. The essential point is to detach as little fighting strength in as few detachments as possible. The strength of the detachment must be sufficient for its mission but no more. The distance separating a minor offensive detachment from the main air offensive will affect the strength of the detachment inasmuch as the smaller the distance the easier it is to reinforce.

Closely connected with the subject of minor offensive detachments is that of reserves. In air fighting it is most important to avoid a full commitment of fighting strength to an engagement until it is certain that all enemy units which can affect the decision have been located or the absence of such units established. This necessity led the tactics of wartime fighting squadrons to include the use of a so-called "top guard"—a tactical reserve—disposed in a position of great tactical advantage above the fight with a view to watching for approaching reinforcements, detecting and engaging them or in case of the approach of superior force breaking off the entire combat and retreating. This tactical reserve was also available to reinforce the attack at the decisive moment in case of need.

The proper use of a reserve is a complicated subject and a most important one. The reserve, if it exists, must be economized

up to the right moment, but when that moment arrives, when a favorable opportunity occurs for its employment to strike a decisive blow, it must be used unhesitatingly and unsparingly. The relative size of the reserve depends on many factors among which are the situation on the surface, visibility, opportunity for the enemy to approach concealed by clouds, and the relative strength of the opposing forces.

One of the most important principles of offensive air warfare is the principle of surprise. We have seen how surprise aided in some of the early aerial victories. Surprise can be achieved by a proper use of the concealment afforded by natural conditions which handicap enemy vision, such as clouds, fog, haze, sunlight, and varied backgrounds which replace the natural features which aid surprise in surface warfare. The use of surprise is facilitated by approaching from above, approaching in the enemy's blind sectors, and at times when enemy attention is focused on other objectives.

The greatest aid to surprise is speed and the high speed of airplanes is, therefore, the cause of the importance of surprise in air tactics. The greater the speed of approach the less time in which to be detected and consequently the greater the surprise.

Air combat has for its primary weapon the gun. Therefore, fire efficiency is of supreme importance. Tactics can aid fire efficiency by providing formations which develop a maximum gunfire in the right place at the right time, but the efficiency and the rapidity of fire then depend on the excellence of gunnery material and the gunnery training of the pilots and gunners. In the last analysis the outcome of air battles depends on the ability to shoot and hit.

The range at which gunfire is effective has a profound influence on the tactical problems of air fighting and if gunnery training can develop the ability to hit at comparatively long ranges it will have made a decided contribution toward victory. Current practice designates ranges as extreme, effective, and close, on the basis of the ability of one individual plane to hit another individual plane. Effective ranges for the fire of a formation enfilading an enemy formation will naturally be far greater. Fire tactics are, however, in all cases based on closing the range rapidly, opening fire at the range at which fire is effective, and maintaining fire until the target is put out of action.

Volumes could be written on the tactics and strategy of air warfare in their relation to sea warfare, but the purpose of this brief discussion has been limited to bringing out the underlying fact that the success of war in the air rests upon the same factors that bring success in war on land and sea; that air tactics differ from surface tactics only as minor tactics; and that the fundamental principles apply even to minor air tactics. The more we study the problems of air warfare in the light of the principles of war as demonstrated by the successful tacticians and strategists of the past the better they will be solved.

TWO DOZEN BOOKS

By Lieutenant Commander H. H. Frost, U. S. Navy

ALEXANDER, according to Plutarch, "was naturally a great lover of all kinds of learning; and Onesicritus informs us, that he constantly laid Homer's *Iliad,* according to the copy corrected by Aristotle, with his dagger under his pillow, declaring that he esteemed it a perfect portable treasure of all military virtues and knowledge."

Napoleon was likewise a great student of military books. "Make offensive war," he wrote, "like Alexander, Caesar, Gustavus Adolpus, Turenne, Prince Eugene, and Frederick; read, reread the accounts of their eighty-eight campaigns; model yours on theirs—it is the only way to become a great captain and discover the secret of the art."

Even a rough soldier like Suvorof advised his godson: "Read well Eugene, Turenne, the Commentaries of Caesar, Frederick II, the first volumes of Rollin and the Count de Saxe." Paul Jones probably had a truer conception of naval warfare than any other person of his era, and this was based not only on his own practical experience, but upon a detailed knowledge of naval history which amazed his listeners.

There are many books on war. Some are more interesting than a romance; others are duller than a textbook. Some are inspired with warlike spirit; others are dry records of facts. Some are frankly and honorably written; others are deliberate propaganda. Some are impartial; others show prejudices. Some are accurate; others are careless. Some express correct principles; others dangerous ones.

In selecting war books to read, we should choose books which will not only impart knowledge, but build military virtues and encourage a spirit of aggressiveness and daring. Further, it must be definitely acknowledged that the reading of military literature is only to supplement, never to replace practical experience at sea; to do a thing yourself is far different than to read how to do

it in books; they have, however, proved one of the essentials in the development of every great leader.

1. *Xenophon's Anabasis.* This first great book on war describes the advance of the Greek mercenaries with Cyrus into the heart of Persia, the death of Cyrus at Cunaxa, and the resolute attitude of Clearchus, who rallied the soldiers and resisted their inclination to surrender. "The generals and captains," wrote Xenophon, "after listening to this address by Clearchus, went away and did as he directed; and thenceforth he commanded, and the others obeyed, not indeed having elected him commander, but perceiving that he alone possessed such qualities as a leader ought to have." After Clearchus and the other leaders had been treacherously murdered by the Persians, the Greeks again fell into a panic, but Xenophon, a simple volunteer, who held no command, raised their spirits with a wonderful oration. He included in this a detailed estimate of the situation which would do credit to any general staff of today. It was replete with the most correct principles of war and constantly breathed an inspiring confidence and aggressiveness. Xenophon became the acknowledged leader of the Greeks and led them home through countless dangers. The book is beautifully written and translated, intensely interesting, filled with principles still applicable after twenty-two centuries and alive with the spirit of offensive warfare. (Available Bureau Navigation.)

2. *Caesar's Commentaries.* This book is available for issue by the Bureau of Navigation. Caesar's pen is mightier even than his sword. His commentaries describe the Roman campaigns in Gaul and Britain, and the civil war in Italy, Spain, and Greece. They are history in its highest form, and wonderfully accurate in every detail. Caesar praises the bravery of his enemies and the skill and resolution of their leaders. Thus he reports Divico, the chieftain of the Helvetii, as saying that his people "had been so trained by their ancestors that they were accustomed to receive, not to give hostages; of that fact the Roman people were witness." In the subsequent battle with the Helvetii, which lasted from noon until dark, he states that "no one could see an enemy with his back turned." In his description of the great battle in which the Nervii were annihilated, he pays the highest tribute to that heroic tribe of the Belgae. The commentaries not only describe the course of campaigns, but they give the reasons for every measure and trace the relation between policy and strategy.

3. *Plutarch's Lives of Illustrious Men.* While these volumes give an excellent idea of ancient history, policy, strategy and tactics, they are primarily of value as a study of men, and man has not changed in eighteen centuries. "They deal with men of the first order," writes Mabie, "and they deal only with men whose careers and achievements have dramatic action and story-telling quality; and these stories of real life are told with freshness, vigor and intelligence. The *Lives* are a mine of information, not always minutely accurate but truthful and full of vitality. They are sound to the heart in moral feeling and judgment; and are, therefore, the best possible textbook for the making of strong men." There are fifty biographies and, with the exception of the last two or three, every one is fascinating and inspiring. Here is Callicratidas, who, when urged to be careful of his life, said, "Sparta will not miss one man." There you see Pelopidas, who, when a friend said, "We are fallen into the enemy's hands," replied, "Why not they into ours?" Now you admire old Antigonas at Andros, who said when the great superiority of the enemy fleet was pointed out, "For how many ships then wilt thou reckon me?" Then we read of Marcellus, of whom Hannibal said: "He is the only man who neither suffers us to rest when he is victor, nor rests himself when overcome. We shall have, it seems, perpetually to fight with him; as in good success his confidence, and in ill success his shame, still urges him to some further enterprise." And finally you see Appius Claudius, who though old and blind, had himself carried into the Senate to make his last speech against the treaty with Pyrrhus. "I bore," said he," until this time, the misfortune of my eyes with some impatience, but now when I hear of these dishonorable motives and resolves of yours, destructive to the glory of Rome, it is my affliction, that being already blind, I am not deaf, too." The Bureau of Navigation has this book available for issue.

4. *Poems of Ossian,* translated by Macpherson. These once famous poems are now almost forgotten and it is difficult to obtain a copy. Ossian is believed to have been the son of Fingal, King of the Scots in the Third Century, A. D. It is claimed that these poems were transmitted in the songs of the bards, collected by Macpherson and translated into English. Others assert that they were originated by the translator himself. Whether authentic or not, they present an unrivaled picture of military life in its most

perfect state. The military virtues, including chivalry to the enemy, are nowhere more beautifully or inspiringly described. In the constant warfare of the Scots with the Irish, Norsemen, and Romans, the great object of life was to perform an exploit worthy to be perpetuated in the songs of the bards. It is a series of such exploits that Ossian commemorates in these songs. Napoleon was a constant reader of Ossian. Suvorof carried them in all his campaigns and one can imagine that some of his fiery love of battle was inspired by Ossian's wild imagery.

5. *Heimskringla,* a saga of the Norse Kings. This book, unfortunately, is difficult to obtain, but will repay your effort. The first half is by far the most interesting. After that the Norse kings did not amount to much. The ruling motives of the Norsemen are well described in the account of Odin's death: "Odin died in his bed in Sweden; and when he was near his death he made himself be marked with the point of a spear, and said he was going to Godheim, and would give welcome there to all his friends. and all brave warriors should be dedicated to him. To some he gave victory; others he invited to himself and they reckoned both of them to be well off in their fate." While the Norsemen were unscrupulous and cruel, they were probably the fiercest and most fearless fighters of all history. Warfare was their entire life and their exploits are almost unbelievable. Sigurd Hiort at the age of twelve, killed a famous berserk and his eleven companions. On another occasion when riding alone he was attacked by the berserk Hake and thirty men and fell only after killing twelve and wounding Hake four times. King Hake of Sweden was mortally wounded after a victorious battle. While still alive he had himself placed in a ship with all his dead warriors; by his orders all sails were set and the ship set on fire. King Ingiald, seeing that he could not resist or escape his enemies, retired to his house, held a great feast in which all his men became drunk, and then fired the house so he and they were burned together. Vagn, taken prisoner after a desperate seafight, refused to accept quarter until it was given to his followers. Havard Hogvande, a famous viking, although both his legs were cut off, used his last arrow against the hostile chieftain. King Olaf Tryggvason, after fighting his ship to the very last, sprang overboard in full armor. When the gallant King Harald Hardrada fell in battle, his attendants refused quarter,

and according to their custom died in a corpse-ring around their king. The Norsemen were remarkable for their self-reliance and versatility; they were remarkable seamen and covered great distances; they were skilled in fighting from ships; they were equally skilled in all forms of fighting on land, even in besieging cities and acting as cavalry; loving battle, they were always aggressive, and expeditions of only a few ships terrorized whole countries. Their galley has become the symbol of seapower and is the central figure of our Naval Academy crest.

6. *Memoires du General Baron de Marbot.* This book is probably the greatest of all military memoirs. The writer's copy is of the sixty-seventh French edition; there is an English edition, of which the Naval War College Library has a copy. Marbot enlisted as a simple hussar in the Bercheny regiment when he was so young that a moustache had to be pasted to his lip to avoid spoiling the appearance of the regiment. In his first campaign he was made lieutenant for a series of exploits and withstood the terrible siege of Genoa; the terms of the surrender permitted Massena to send two officers through the Austrian lines to General Bonaparte; Marbot was selected for this duty and served on Bonaparte's staff at Marengo. From this time on he alternated between duty in cavalry regiments and on the staff of marshals, serving in every campaign for fifteen years, including Waterloo. He was on the staff of Marshals Bernadotte, Augereau, Murat, Lannes, and Massena, and at times served temporarily on the staff of the Emperor. During the campaigns of 1812 and 1813 he commanded a splendid cavalry regiment, the 23d Chasseurs. During the latter part of the retreat from Russia this regiment was one of the few which maintained its organization and served in the extreme rear guard under Ney; at the end there were so few horses that the regiment could not act as cavalry and those remaining were used to draw sleighs; as these could each carry two men, Marbot succeeded in bringing out practically all his men, except those killed in battle. The day before Waterloo Marbot was nominated general of brigade for a brilliant feat; in the battle, with the 7th Hussars and a battalion of infantry he covered the extreme right of the French Army and held up the Prussian advance by determined resistance. In his numerous actions Marbot received twelve wounds. His memoirs, if once commenced, will be read over and over again. They

are more fascinating than any novel. While possibly not always accurate in details and perhaps exaggerating his personal exploits, they give a most intimate picture of the Napoleonic Wars and of their famous figures. The biographies of Augereau, Massena, and Lannes read like fairy tales. The descriptions of the engagements and charges of the 23d Chasseurs are masterpieces in the study of command and morale. Marbot describes the exact composition of the various staffs on which he served and their methods of operation. The ill effects of the jealousies of the marshals are emphasized. Marbot enlivens the memoirs by using anecdotes of great soldiers and accounts of his personal adventures. He gives a particularly fine description of Lannes, probably the greatest of the marshals. Before Ratisbonne volunteers twice led the assault on the walls and each time were annihilated. At the third call no one stepped forth. "Very well!" Lannes cried, "I will show you that before I was marshal I was a grenadier, and I am one still!" Seizing a ladder he started for the breach, and was held back only by his aides. "At the sight," writes Marbot, "of a marshal of the Empire disputing with his aides de camp as to who should mount first to the assault, a shout of enthusiasm rang through the division. Officers and soldiers wished to march in the lead, and claiming this honor, pushed us, my comrades and me, aside in trying to take the ladders." The next assault, led by the entire staff, won the city.

7. *The Influence of Sea Power on History, 1660-1783,* by Mahan. This is Mahan's first and greatest book. As it covers such a long period, more action is condensed into a single volume than in any of his works and it is accordingly the most interesting. This volume created probably greater effects in the world than any military book ever written. While it covers a period during which conditions were quite different from those at present, this book still furnishes invaluable information on naval strategy, tactics, and leadership. Where Mahan treats of military warfare he is not on such solid ground and tends to exaggerate the influence of sea power at the expense of military power. One point of interest is Mahan's opinion as to the slight effect of raids on commerce, which have so much in common with aircraft attacks on industrial centers for which so much now is claimed. This book is in the War College Library issued to ships.

8. *England in the Seven Years' War,* by Corbett. This eminent author has advanced Mahan's theory of naval warfare, in addition to having a less complicated and easier style. We are indebted to him for many accepted principles of naval strategy. This book is his best effort. It is of particular value in revealing the skill of Pitt in coordinating the diplomatic, military, and naval forces in his masterly national strategy in contrast with the weakness of preceding politicians. It also describes in detail a number of combined operations; Havana and Quebec were examples of splendid cooperation between the naval and military leaders. Attacks on Rochefort and Cherbourg were not so successful. Of the first Wolfe said: "The famous council sat from morning until late at night, and the results of the debates were unanimous not to attack the place they were ordered to attack." This book is exceedingly well written and very frank, in contrast with other works by this author, which have a flavor of propaganda. It is included in the War College Library issued to ships.

9. *The Campaign of Waterloo,* by Ropes. This book gives a masterly exposition of command and staff work, although this campaign shows what not to do rather than what to do. Staff work practically did not exist in the French Army, and Ney who joined just three days before Waterloo did not even have a staff. It was rare that an officer knew what his orders were, and rarer still that he made a real effort to execute them. The British and Prussians were little better. No arrangements were made for the junction of the two armies in a defensive campaign, because, as Muffling said, "no doubt could be raised on the point." But this was the principal point upon which the entire campaign revolved. Bulow did not get his corps into the battle of Ligny because he delayed marching for a day; in his defense he said that he was not informed that hostilities were imminent. But the cooperation and initiative of the Prussian corps commanders after Ligny, where Blücher was ridden down in a cavalry charge and badly hurt, was remarkable. On the 16th the British chief of staff gave Wellington a most inaccurate report of the dispositions of his own forces, and this created confusion and distrust when forwarded to the Prussians, forming the basis for Gneisenau's belief that the British had deliberately left them in the lurch at Ligny. The relations between Napoleon and Grouchy are truly heartrending,

an entire series of errors on both sides. In analyzing a campaign from this viewpoint, the author has provided a most interesting and really great book. It is available for issue by the Bureau of Navigation.

10. *Stonewall Jackson and the American Civil War,* by Henderson. The author makes not only a careful analysis of the character, methods, and accomplishments of Jackson, but gives a complete and impartial account of the great campaigns in which he took part, from both Federal and Confederate viewpoints. One point to which great emphasis is given is the interference of politicians with commanders in the field. It was not the least of Jackson's accomplishments that he greatly reduced this practice in the South by a threat to resign his command, while his opponents suffered from Lincoln's amateur strategy. After reading this book it will be refreshing to recall the statement of General Pershing to Repington that "no C-in-C was ever left with so free a hand." The staff work of the Civil War armies is carefully analyzed, numerous mistakes are pointed out, and the necessity for a general staff clearly demonstrated. The general lack of discipline in both armies is pointed out and Jackson praised for the iron discipline he enforced in his command. The book is most interesting and many passages are really inspiring. It is included in the War College Library issued to ships.

11. *Battle Studies,* by Ardant du Picq. This little book is one of the greatest that has ever been written on war. Du Picq analyzes battle from the viewpoint of the soldier and shows how he is affected by its various incidents and reacts to them. His picture of battle is entirely different from the battle of history, but one can see at once that it is a true one. He first examines ancient battle and shows that the success of the Roman legion was due to the fact that its organization and tactics were based upon "a profound knowledge of man's heart." He demonstrates that the success of Hannibal, the only leader who could consistently beat the legion, was due to "his admirable comprehension of the morale of combat, of the morale of the soldier, whether his own or the enemy's. Du Picq shows that modern battle makes far greater demands on the resolution of the soldier than ancient fighting and emphasizes the necessity for closely-knit organizations where the soldiers are confident in their leaders and in each other and are welded together by a strict discipline enforced by both the

officers and the men themselves; for tactical methods which are based on moral, in addition to material, considerations; and for military institutions and traditions of long standing based upon our civil institutions and national characteristics. It is absolutely necessary to be familiar with this book to correctly interpret military history. (War College Library.)

12. *Military Policy of the United States,* by Upton. Upton does for military policy, administration, and supply what du Picq does for tactics. His book, based throughout on the highest authority, is a terrible indictment of our military system. "Such a dearth of public spirit and want of virtue," writes Washington, "such stockjobbing and fertility in all the low arts to obtain advantages of one kind or another in this great change of military arrangement I never saw before, and pray God's mercy that I may never be witness again." "If Job had been a general in my situation," said Schuyler, "his memory would not have been so famous for patience." General Gaines reported in 1812: "If I were called before heaven to answer whether we had not lost more men by the badness of the provisions than by the fire of the enemy, I should give it as my opinion that we had." Lincoln, in a letter to Hooker, discloses a situation which reminds us of present conditions: "I much fear the spirit you have aided to infuse into the army, of criticizing their commander and withholding confidence in him, will now turn upon you. Neither you nor Napoleon, if he were alive again, could get any good out of an army while such a spirit prevails in it." Upton's masterly presentation of our military policy with its defects has had an important effect in bringing the army to its present state of efficiency. This book is in the War College Library issued to ships.

13. *Napoleon as a General,* by York von Wartenburg. This noted book is probably the best description of the characteristics and methods of Napoleon. In this study the author particularly emphasizes the iron inflexibility of Napoleon, citing as an example his attitude after Nelson had destroyed the French Fleet at Aboukir: "Whatever may have passed at this moment through Napoleon's mind, his companions read no sign of it in his face. Of course he must have understood what a terrible impression this stroke must make on the army, already so disheartened; but he only felt the increased necessity of meeting the frowns of fate and dejection of his men with firmness. Both leaders and men

now more than ever saw, that the future safety of the army depended solely upon this man of genius, who set fate at defiance."

14. *Letters on Strategy,* by Prince Kraft zu Hohenlohe-Ingelfingen. This is a delightfully written description of the Jena Campaign of 1806, the campaign of 1859 in Northern Italy and the Metz and Sedan campaigns in 1870, by an officer who commanded the artillery of the Prussian Guard. Strategy, command, and staff work are treated in great detail and simplicity. The chivalrous and soldierly bearing of the author shows itself on every page; he shows the effects of that perfect teamwork in the Prussian Army, whose leader said after the capture of Paris: "If one considers how small an amount of success is due to one's individual self and through what weak instruments God manifests its greatness, it is a simple matter to be modest." This spirit seems to have been absent in 1914. This book is in the War College Library issued to ships.

15. *The World Crisis,* by Winston Churchill. These two volumes cover the first two years of the war, including the relations between the Admiralty and the War Office, the escape of the *Goeben* and *Breslau,* the Antwerp episode, the Battle of Falkland Islands, operations in the North Sea and at the Dardanelles. In them Churchill defends his leadership as First Lord of the Admiralty. While the author is an "interested party," he has certainly produced two great books, which contain so many valuable facts and ideas that no naval officer can afford to leave them unread. They present an accurate picture of national strategy in modern warfare and describe the functioning of the British government and its relations with the commanders in the field. Churchill constantly points out the need for cooperation and aggressiveness, he shows how the customs of the naval service prevented ships from being properly risked in war; he attacks, however, the war of exhaustion on the Western Front. The reader will be compelled to admit the correctness of many of his arguments and agree with much of his conduct of operations, despite the fact that he was a politician controlling military and naval operations in exactly the way of which Henderson complains so bitterly in *Stonewall Jackson.* This book is available for issue by the Bureau of Navigation.

16. *Gallipoli Diary,* by Ian Hamilton. As this diary was written from day to day during a desperate campaign, it gives a most

interesting insight into the moral reactions of a commander-in-chief while under great responsibility. It also treats of the relations between a commander in the field and the home government and shows how Sir Ian tried "to steer a course between an optimism that deprives us of support and a pessimism that may wreck the whole enterprise." He shows the methods of building up morale after heavy losses and the necessity for truth in war-time propaganda and censorship. He stresses throughout the offensive idea. Sir Ian writes with an honest soldierly spirit which will appeal to every military reader and shows his love of the military profession. In his spirited description of the wounded *Inflexible* he says: "Ten thousand years of peace would not produce a spectacle of so great virtue." He shows that chivalry in warfare still remains in his eulogy of the heroic Doughty Wylie: "He had no hatred of the enemy. His spirit did not need that ugly stimulant." If Sir Ian will not be counted a victorious general by history, he will at least be admired as a real soldier. Some copies of this book have been issued to the service and others will be issued on request.

17. *The German General Staff and Its Decisions, 1914-1916,* by von Falkenhayn. This is an extremely well written, frank, and informative book. The reasons for the various decisions of the German General Staff up to and including Verdun are fully and frankly stated, and, despite criticism of them by Ludendorff and Hoffmann, they will be given considerable weight by the reader. Even Verdun takes on a new appearance after reading Falkenhayn's detailed estimate of the situation; he alone was in a position to view the situation on all fronts and his claims as to the effectiveness of this offensive are now greatly substantiated by Repington and Dewar. "It may indeed be fairly argued," says the latter authority, "that if the Crown Prince's offensive failed to secure victory for Germany in 1916, it averted a German defeat in that year." The splendid staff preparations for the offensive of 1915 against Serbia are worthy of imitation. While the greater part of the book deals with military strategy, considerable space is given to the relations of the general staff with the navy and civil government. This book is available for issue by the Bureau of Navigation.

18. *Ludendorff's Own Story.* This is a most able exposition of modern warfare. While it is concerned mostly with strategy

and tactics from the viewpoint of the general in the field and the chief of the general staff, it describes also the dealings of Hindenburg and Ludendorff with von Falkenhayn and the other political, military, and naval leaders of the Central Powers, the administration of conquered territory, the efforts made to develop the German economic forces, and the use of diplomacy and propaganda. It is particularly valuable because of the wide field covered. During the Russian campaign and as regards Verdun he differs with von Falkenhayn and this part of his book should be compared with the latter's account. Ludendorff is accurate and frank, except possibly in his description of the last two months of the war, and this part of his book should be compared with *The Collapse of Central Europe,* by Nowak. Where military events are being described the book is intensely interesting, but at some other times, where administration and policy are discussed, it tends to be somewhat dull. This book is in the War College Library issued to ships.

19. *The Story of Our Submarines,* by Klaxon. This is a really inspiring little book. It gives a vivid picture of war-time life on a submarine and recounts typical adventures of British boats. It is extremely well written, does not contain an uninteresting page, and gives the reader the real atmosphere of the submarine service. This book is available for issue by the Bureau of Navigation.

20. *The Fighting at Jutland.* This remarkably fine book contains the personal accounts of British officers on all types of ships. This phase of naval history concerns most of us more intimately than the tactics of the battle as viewed by the leaders, and this book pictures most graphically fighting at sea as it affects officers and men in subordinate positions. The accounts, while admittedly often inaccurate, impress the reader with their absolute honesty. There is not a bit of propaganda or a slur at the enemy in the whole book. Many inspiring incidents are related and there are a number of remarkable battle photographs. This book is available for issue by the Bureau of Navigation.

21. *The Two White Nations,* by von Hase. This interesting volume has been translated into English under the title *Kiel and Jutland.* The greater part of the book describes the Battle of Jutland, as viewed by the gunnery officer of the *Derfflinger.* It is written in a straight-forward style without attempt at propaganda.

It gives a vivid description of the moral reactions of a crew when under an overwhelming and devastating fire. It contains valuable gunnery information. Some copies of this book have been issued to ships by the Bureau of Navigation, but no more are available for issue.

22. *The First World War, 1914-1918,* by Repington. The author had interviews with practically every noted leader on the Allied side during the war. He reported these in detail in his diary, together with his own impressions. Whatever may be the ethics of publishing to the world such personal interviews, Repington discloses the actuating motives of the allied leaders to have been at great variance with what they were popularly supposed to be during the war. It is necessary to read this book in order to clear one's mind of the atmosphere of propaganda which still has not been brushed aside. It must be remembered that Repington had strong prejudices against Lloyd George and other political leaders and due allowance must be made for this. While his book is marred with long descriptions of war-time social activities, these are not entirely without interest in showing how Great Britain was governed during the war. This book is available for issue by the Bureau of Navigation.

23. *Sir Douglas Haig's Command,* by Dewar. This book probably represents the position of Sir Douglas Haig, as the author is assisted by one of his staff officers. While it presents the case of an "interested party," it makes a most able and convincing one, and sheds much new light upon the Western Front situation. It describes in detail the relations between the British and French commanders and their political leaders. It alleges that the French spirit was broken by Verdun and that after Nivelle's defeat in 1917 their army was on the point of dissolution. It shows that our army did not do nearly as much as we consider it did. It presents startling facts concerning the conduct of the supreme command by Foch and shows how Haig insisted on carrying through the offensive in his own way. The excellent descriptions of the battles should be read in conjunction with Sir Douglas Haig's official despatches, which contain remarkably fine maps. The campaign of exhaustion is as vigorously defended by Dewar as it is denounced by Churchill. Many incidents of heroism lend interest to the book. Some copies have been issued to ships, but no more are available.

24. *The Collapse of Central Europe,* by Nowak. This most illuminating book describes political, economic, and military conditions in the Central Powers during the last years of the war. It traces the various peace offensives of the Central Powers, the relations between the political and military leaders in the four allied countries, and vividly describes the terrible conditions under which the civil population lived. It shows how Austria ceased to exist as a nation as early as January, 1918, and that the army crumbled away gradually due to total lack of support. It relates how the Bulgarian army collapsed without resistance and marched home. It relates most accurately the successive moves leading to the Armistice and shows the breakdown of the German military leaders. It depicts the gradual dissolution of Austria-Hungary. This book is written in the clearest and simplest style and impresses the reader as being absolutely impartial and accurate. Copies of this book have been issued to ships and others will be issued on request.

THE NAVY AND NAVAL AVIATION

By Lieutenant F. W. Wead, U. S. Navy

SO MUCH has been written and said, under oath and otherwise, about aviation in general, and for and against a United Air Service specifically, that more seems superfluous. Every large newspaper in the country must feel the need of an "aviation only" filing room, and the next step of the various special investigating committees will doubtless be to offer a bill before Congress to provide suitable stowage for their records.

During the heat of any such controversy statistics, arguments, and facts are presented with a rapidity and in an amount which practically prevents proper analysis, and it may be said without rancor that much testimony is, under such circumstances, at the very least tinged with prejudice. It appears that no time could possibly exist for complete frankness concerning many of the details of naval aviation and a thorough consideration of arguments advanced in favor of the united air force, in order that unsatisfactory conditions where they occur may be improved and that smoother coordination and better understanding may prevail. It is to be regretted that many glittering generalities which will not bear investigation have been written about aviation, in some instances by people who are supposed to be well informed in aviation matters, but apparently are not. The influence of such statements is naturally bad.

In order to remove any doubt in the minds of those who read this, I would like to state briefly that I am frankly convinced:

a) That any consolidation of Army and Navy aviation personnel and operations other than in joint problems would have an extremely deleterious effect on the efficiency of the fleet, the Army, and the defenses of the country.

b) That a striking air force independent of the Army or the Navy is in no way essential to a country strategically located as is the United States, and will continue to be purposeless until the effective reliable range of aircraft, with suitable useful loads, is increased to 5,000 miles. The time when such aircraft will be pro-

duced certainly does not appear to be within the next decade. This in no way belittles the value of such an air force for nations located within actual aircraft striking radius of a probable enemy.

c) That benefit to the Army, Navy, and to the aircraft industry is certain to occur with more thorough cooperation in experimental work, design, purchasing, and production.

d) From intimate association with naval aviation for the past six years, that no doubt can exist that remarkable strides have been made in aircraft, engines, and operating methods.

Whenever unrest seethes to the point where it prompts measures to overthrow existing conditions, it may be reasonably assumed that dissatisfied personnel or the influence of a strong individual or group is a primary cause, regardless of the fact that suggested changes may be apparently actuated by altruism. This is clearly shown in the united air force proposal; first, by the leadership of Colonel Mitchell, next, by the perhaps not openly-expressed opinion of a number of individuals connected with the aircraft industry that a change is desirable, and finally by the dissatisfaction of the army air service personnel, particularly with the single list for promotion. It has been repeatedly stated that all officers of naval aviation were unanimously against such a change. This is not a fact, the true situation being about as follows:

1) Nearly all naval officers including aviators have resented the hue and cry that the battleship was finished as a war weapon; in most cases they have been unable to see that the requirements of the United States included an independent striking air force with aircraft of present characteristics, and they have been convinced that the logical development of naval aviation lies with and through the fleet.

2) From an actual canvass of naval aviators at various stations, it is believed that approximately 85 per cent were in favor of a radical change from existing conditions at the time of the hearings before the Congressional Special Investigating Committee. These officers would have voted for a United Air Force or a Naval Flying Corps at that time, had they had voting power. In recent months this sentiment apparently has swung against a separate air service and for a Naval Flying Corps. It is realized that this is in direct contradiction to much that has been said before on the subject. I can only state that as far as is known no previous canvass was ever made, that in this instance only direct questions

were asked, without qualifying premises, and that those who have previously testified as to the sentiment of naval aviation personnel to the contrary must have been misinformed as to the facts. In view of the policy of the Navy Department at the time, it may be pertinent to explain that many officers would have hesitated to subscribe to an officially-requested opinion of this sort.

No disloyalty existed in such opinions. They were the honest fruit of thought and experience, resulting in the belief that existing difficulties in naval aviation, which seem inherent in the present naval organization and not possible of satisfactory solution in the near future, might thus be overcome. Where such a widespread desire for change exists the situation cannot be ideal. The primary reason for this discontent can and must be overcome if entire harmony and maximum efficiency are to be gained.

That there is no readily-apparent ideal organization for the air forces of a nation is attested by the continuous struggles, criticisms, and changes which have taken place both here and abroad. The primary considerations concerning such an organization seem to be:

1) Satisfactory air service to the Army.
2) Satisfactory air service to the Navy.
3) Satisfactory defensive and offensive air striking force, embracing the establishment of an air arm separate from the Army and Navy.
4) Economy and efficiency alleged to be gained through unified design, material control, and training.

The United States because of its strategic location and the short radius of existing aircraft is now not concerned with a separate air striking force, and a great deal of testimony from the Army and Navy air services and from the industry has shown the defects and difficulties which a slight theoretical gain in economy, due to consolidated material effort, must offset. The progress of the past five years in aircraft design, production, and equipment has been remarkable and the present situation will continue to improve as closer cooperation and simplified working methods prevail between the divers elements of the aircraft material situation in the United States. Rome was not built in a day. Any new organization, in order to achieve progress, must risk mistakes, which the perverted critic may seize and distort to strengthen his funda-

mentally unsound arguments. The progress made by the Army and the Navy in meeting their own particuar air needs, since the war, has been tremendous. It is to be regretted that in combating propaganda for a United Air Service, a considerable number of individuals have introduced arguments, not of principle, but of detail, which are demonstrably unsound. The tried and proven facts are sufficient to clearly prove the case against unification, and extraneous, doubtful matter is dangerous.

With adequate air service for the Army and for the Navy and with the satisfaction, contentment, and efficiency of air service personnel, the United States is assuredly concerned. These matters are not the responsibility of any individual or any central agency, but rest primarily and respectively on the whole Army and the whole Navy. Moreover, the most decisive and clear cut answer which the Navy might oppose to any suggested plan of unification would be furnished by the fact that complete satisfaction and efficiency obtained, as regarded naval aviation, personnel, material, operations, and air service to the fleet.

Where proponents of the United Air Service have stated that duplication exists, let us make doubly sure that it is eliminated; where they have charged lack of sufficient cooperation and information towards army material development we should cooperate to the *n*th degree; if our personnel is not satisfied we should endeavor to eliminate every source of dissatisfaction. This is necessary not merely to answer arguments for unification which seem bound to occur annually, but better to attain maximum efficiency and to take advantage of criticism, much of which may be destructive, but some of which furnishes plans for growth.

There is no situation abroad from which the United States can draw applicable precedent concerning its air service organization. The general situation in England, insofar as past development of the army and navy is concerned, is generically similar to that in the United States. England has an adequate and efficient army and a navy of major importance. England, however, needs a striking air force and the United States does not. Upon unification of all aerial activity the British Air Ministry assumed the direction of such naval aviation as existed, as well as that of the army cooperative units. The army and the independent air force were apparently satisfied while the navy, except for a short somnambulant period, decidedly was not. This dissatisfaction culminated in

placing the fleet air arm under the operating control of the Admiralty, while it relied upon the Air Ministry for material. This arrangement is not working out satisfactorily, and from the press and from other accounts, it is not difficult to believe that in a short time the English Naval Air Service will be organized and directed in a manner similar to our own. It is useless to assume that with proper direction and foresight, the Royal Air Force would have ensured efficient material and air service to the British fleet. The fact remains that it did not. British personnel is equal in ability to our own, and any similar organization in the United States would doubtless fail in a similar manner. The personnel of the British fleet air arm will, it is understood, be largely drawn from the navy, and will have the same status as Royal Air Force personnel, i.e., permanency in their chosen field, a consideration vital to its success.

In France, a unified aircraft design and material section is maintained, with all personnel in a unified air service, though permanently allocated to the army, to the navy, or to the striking air force. The results are apparently satisfactory, but it must be remembered that the French Navy itself is not as progressive and aggressive as our own, and in the matter of its air requirements is, therefore, prone rather to be satisfied than otherwise with what it receives from the hands of the ministry. The same applies to Italy, where a United Air Force exists. In Italy and in France, moreover, the fundamental requisite is defense from attacks by air. These countries are within striking distance of aircraft from neighboring countries, which constitute their possible enemies. The United States is not.

Japanese naval aviation, it is understood, is similar in organization to that of the United States at the present time.

In any event, practically every country in the world, whatever form its direction of aerial effort may take, has accepted the assignment of personnel to aviation as a permanent life work. In our own United States the Army has also likewise accepted this essential policy. Granted that naval aviation personnel must to a certain extent be naval, must be sea-going, and must attain a fundamental naval education and experience with naval contacts, naval high command, and naval associations, it must primarily be expert in all phases of naval aviation operations and methods and material, a life's task itself.

We may feel assured that the personnel phases of aviation are at present, and probably will continue to be, of maximum importance.

The current belief among naval officers, that to be an excellent naval aviator, one must also be an excellent naval officer, requires careful scrutiny. Closely coupled with this is the policy that it is desirable for naval aviators to spend, say, five years with aviation, then three years with the fleet. This policy will probably never be carried out, due to the scheduled yearly expansion of aviation, to casualties, and to the difficulty so far encountered in securing and training new officers for aviation work. The advisability of such a policy is decidedly dubious, while the fact that it exists places aviation officers in an uncertain and unsatisfactory status, and doubtless deters many young officers from applying for aviation duty. It was fostered by the idea that aviation officers who reached the grade of captain and commander, for whom there would not be sufficient aviation administrative positions, would thus be enabled to continue their careers in the surface navy. Such officers, however, after much aviation duty would not be qualified for responsible fleet or shore commands, other than in aviation.

No individual with the requisite mental or physical capacity exists who can meet the requirement of being a thoroughly experienced aviation officer and at the same time a thoroughly experienced battleship officer. Such shifts of aviation and sea duty would make the individual neither fish nor fowl; out of touch and inexpert in both aviation and ships. "Familiarity with the seagoing life" is another trite and misused phrase. The naval aviator must first of all be "air going," whether it be from land, water, carriers, or catapults. His seagoing life and all that he needs of it will be acquired as he moves from place to place and operates with the fleet at sea and from bases. His knowledge of aviation seamanship is acquired by this experience, and I cannot but believe that a cruise as watch and division officer or first lieutenant would cause him to lose his skill rather than enhance it. One does not moor ship in aircraft.

There can be, on the other hand, no doubt that for directing effective bomb and torpedo attacks, for defending fleets, and other similar matters, a knowledge of fleet formations, maneuvers, and tactics is essential. Aircraft scouts and spotters, leaders of bombing and torpedo flights, and of fighting patrols must be familiar

with fleet tactics. Their education in this science must come from study, work on the game board, association with ships, participation in cruises, and observation of fleet problems from the air, just as ships' officers observe from their ships. Assignment to ship duties in no way improves the position of the aviator in this regard, and curtails his development for war.

Someone has remarked that there has never been a demand for a separate submarine service, or for destroyer duty only. The problems are not the same. Aviation is essentially and fundamentally a different profession, while submarines and destroyers have much in common with other naval surface craft. Submarines are water craft; airplanes are aircraft. Aviation material and methods form a profession in themselves, which in the case of naval aviation should be closely allied with the regular naval profession. At the same time, however, the two are not the same and one cannot be an expert in both. The problems of aviation engineering, aircraft design, maintenance, operations, and tactics have no parallel in fleet work.

To quote from a recent article by Captain Johnson, "Efficiency Weakened":

> There are other somewhat minor considerations of the same nature which may be mentioned here. If the Navy is required to use in its aviation service officers who are trained for the air alone, then it will have insufficient work for those officers to do when they are attached to sea-going vessels. The naval aviator on board ship actually spends comparatively little time in the air, so the interests of general efficiency and general morale demand that he be given other duties, and those duties must necessarily be naval duties, the duties of trained naval officers.

This displays a somewhat common lack of perception as to what a naval aviator should be and know and do. If his spare hours are properly utilized in the supervision of his division, of his catapults and airplanes and other material; in sending spots from the air during all possible gunnery drills; in radio practice; in practice at the spotting board; in studying fleet tactics and fire control problems; in developing air navigation material and methods; in working out all phases of aircraft utilization with the fleet; in studying his engine and airplane, overcoming minor defects, improving operating conveniences; in constructive criticism leading to improved design and performance; in developing material, signals, and methods for inter-plane and plane-to-ship communication; in performing all possible utility service for his ship;

in squadron or division air work, formation-flying and tactics, including coordination with surface vessels and other aircraft; in carrying out all phases of flight work tending to improve his skill as a pilot; in studying and developing scouting methods; in carrying out his prescribed annual gunnery, bombing, or torpedo exercises with a satisfactory score; in preliminary practice and elimination of material defects; in meeting the requirements of the annual visual signal and radio competitions; in developing the radio compass; in flying all possible types or aircraft under all possible conditions; familiarizing himself with aircraft bases and flying conditions in the area of fleet operations; in performing assigned tasks in fleet exercises and problems, and in doing the enormous amount of self-training which he must undergo to be properly fitted for war, the naval aviator's days will be completely filled, without standing watches which in no way improve him professionally from a *naval aviation* standpoint, and he will be ready to carry out efficiently any aviation duty as he advances in rank. In my brief experience, the constant training and continual education of naval aviation personnel has proved the greatest difficulty. An aviator must be a peculiar combination of administrator, leader, and workman until he has reached a seniority above that of a squadron commander, when the latter requirement becomes nonessential. It may be noted, however, that sound decisions of administration and leadership can be made only by one with years of experience in actual flying and "work" with the material which goes hand-in-hand with it. For example, gunner's mates, radio operators, and signalmen can accompany aircraft only in rare instances; and in many cases only the pilot is available when work in their specialties is of vital importance, e.g., in flight. Boresighting, synchronizing and gun-adjustments; radio and flashing-light signals, and their like, require constant practice and much experience before expertness is attained. Similarly the erection, alignment, and maintenance of aircraft, and the operation of aviation power plants require more detailed supervision and more expert knowledge than any other class of naval material. A continuous re-assimilation of what is already known has gone on with little marked advancement in methods or functions due to this instability of detail. The turnover due to natural causes is tremendous. As a result, naval aviation has operated since its inception with only a nucleus of trained and experienced officers,

and as a further result many sound policies developed by hard experience have later been ignored. To add to this natural difficulty an artificial turnover by insisting upon alternate periods of sea and aviation would be homicidal.

One of the greatest drawbacks of naval aviation, as it exists today, is the fact that all responsible senior positions are filled by naval officers with little or no aviation experience. It will take time to improve this, since the number of senior officers with aviation experience is small. Nor should one overlook the fact that the interest of the senior officers now detailed to aviation command is first of all in surface ships; they cannot offend or disagree with the fleet to which they must return; they have little conception of the problems or the motives that confront their subordinates; their status is temporary and their every act is tempered by that fact. As a result they yield in many matters where firmness is required; their tendency is to settle things in the least troublesome way; and they do not sufficiently encourage the use of aviation either within itself or within the fleet.

This *temporary* feeling extends to the most junior officer in naval aviation, and has a direct reaction upon their brother officers in the fleet. It is a situation under which smooth efficiency, supreme interest, confidence, and maximum effort can never be obtained, and is inherently unstable. It is probably the most pertinent reason for the present unrest. Today the underlying attitude of many ship officers seems to be that individuals in naval aviation are ruining their naval careers for a few years' "pleasure" at flying with 50 per cent extra pay.

The life of a naval aviator on aviation duty should, for a well rounded experience, include a two- or three-year cruise in each of the following, after his training at Pensacola:

1) Fighting squadron (carrier or catapult).
2) Observation squadron (carrier or catapult).
3) Torpedo and bombing squadron (carrier or catapult).
4) Scouting or utility squadron (tender).
5) Engine or aircraft overhaul; erection or test; or similar detail at a major air station.
6) Duty in the Bureau of Aeronautics.
7) Training duty.
8) Coastal patrol work (air station).
9) Staff duty.

As the aviator progresses through his professional life, regardless of the type of duty to which he may be assigned as outlined above, his duties and responsibilities are comparable with those of a battleship officer and in the earlier stages might be classified as:

1) Pilot.

2) Assistant head of a squadron department, as engineer, flight or gunnery.

3) Head of a squadron minor department as radio, communications, navigation.

4) Head of major department in a squadron, as flight, gunnery, engineer.

5) Executive of a squadron. Head of major department at a shore base.

6) Squadron commander. Air station executive.

The idea apparently exists that all aviators and all kinds of flying are alike and that little technical knowledge or experience is required within aviation. In point of fact, methods and material in various units afloat and ashore are entirely different and an expert fighting pilot would require much experience and training to become expert in torpedo or bombing work or in the repair or assembly departments of a fleet air base.

An aviation officer, to be fitted for higher naval aviation command, must "grow up" in aviation and have the varied and sound experience outlined briefly above.

To quote from a paper recently prepared by Lieutenant (jg) M. B. Sterling, U. S. Navy:

> Naval aircraft are viewed at present by the Navy in much the same light as submarines are viewed, and officers performing aviation duty are considered simply as naval officers who have specialized in aviation as other officers have specialized in submarines.

This is an erroneous point of view and the writer believes that only when a true perspective of aviation is acquired by the Navy at large, will the development of naval aviation reach its full scope.

In the first place, everyone must realize that before aviation can be naval, it must be aerial. Before naval aviation can be a naval service, it must be an *air service*. Regardless of what we call naval aviation or how we wish to regard it personally, it is nevertheless an air service fundamentally, and it is naval only because it works for the Navy.

All the requirements for a separate service are met in naval aviation. It requires its own kind of material and weapons and its own specially trained personnel, who carry out air service duties and not naval duties.

In addition to our failure to see clearly the necessity for a unified command of the Naval Air Service, we have also failed to see that the officers of that service must be just as thoroughly trained in air service fundamentals as naval officers are trained in the fundamentals of the naval service. It is the opinion of the writer that there is just as much to learn.

Graduates from Annapolis are considered to be in strictly a training status for two years after they leave the Naval Academy. They are given duties accordingly. This has not been done in the Naval Air Service, although it is just as important that the officers of this service be thoroughly trained. Their knowledge of the construction, maintenance, and repair of aircraft, aircraft engines, aircraft radio sets and aircraft ordnance must be thorough if we are to have a really capable Naval Air Service.

To sum up, there are two things which we must do to get satisfactory aviation for the Navy. They are:

First.—Recognize that the Naval Air Service is, in reality, a separate service.

Second.—Apply sound military principles of command, organization, and training to this separate service.

The efficiency of any military organization depends, in the final analysis, upon the efficiency of the officer personnel. The writer believes that this statement rests upon bedrock and may be regarded as axiomatic.

The efficiency of the officer personnel of a military organization, other things being equal, depends upon the morale of the officers. If we can show, then, that the morale of the officers in a separate Naval Air Service would be superior to the morale of naval officers at present in naval aviation, then we will have proved that naval aviation would gain much in efficiency if organized as a separate service.

The morale of the officer personnel at present in naval aviation is low for five major reasons. These are, in order:

1) These officers feel that they are doing transient duty instead of being engaged in a lifelong profession.

2) They feel that eventually they will return to the line and that

their years of aviation duty will be a serious handicap after they leave aviation.

3) They are continually seeing senior officers, of much less or no aviation experience, put over them in command.

4) They feel that the Navy does not appreciate the complexities of modern aviation nor give credit for the wide scope of special knowledge which a naval aviator must have. The fact that naval aviators must take regular line officer's examinations which necessarily ignore aviation, else other line officers could not pass them, gives credence to this view.

5) They feel that aviation work, no matter how splendid, will be of little or no benefit to them when they come up for selection in later life.

If the reader will carefully digest the above reasons, he should agree that they are enough to seriously lower the morale of the best officer. It is also equally evident that the organization of a separate Naval Air Service along sound military lines will overcome each and every one of them. It would seem that our proposition is proved.

The following quotations set forth clearly the current attitude of many towards the career of a naval aviator.

From a recent mimeograph document issued by the Navy Department:

III SEA AIR WORK A SPECIALTY

Naval aviation must have extensive training, such as will prepare it for the following particular tasks:

a) Patrol of trade routes in the approaches to terminal ports.
b) Attack on enemy vessels discovered in the sea patrolled.
c) Attack on enemy ships lying in their bases.
d) Attack on enemy naval bases.
e) Forming protective escorts for convoys.
f) Reconnoitering for the fleet.
g) Attack on enemy aircraft prior to, and during a fleet action.
h) Bomb and torpedo attack on enemy vessels during a fleet action.
i) Spotting for gunnery during a fleet action.
j) Laying of smoke screens during a fleet action.
k) Screening fleets against submarines.

In order to successfully carry out these different phases of sea air work, naval aviators must not only be able to fly and to fight in aircraft, but they must also be naval tacticians, navigators, and seamen. This means a sea training of years. Such a personnel must know thoroughly all types of our own and enemy vessels, their ability to maneuver, powers of offense and

defense, and sea value under different conditions of weather. Naval aviators must be indoctrinated in the battle tactics of our own fleet. They must be able to think in terms of naval warfare, and be responsive to the commander-in-chief's mind. A mistake in their report upon making contact with enemy forces may, later, bear heavily on the outcome in battle. They have need of experience in naval gunnery. Lack of ability in controlling the opening salvos of their fleet in action, may result in the difference between victory and defeat.

I maintain that in the above article numerous statements are distinctly misleading: "Naval tacticians, navigators, and seamen" are terms which refer in a broad sense to the more experienced officers in our Navy. A naval tactician, capable of handling a fleet, must have a foundation of much experience, primarily in the battle-line, but also in tactics of light forces, submarines, destroyers, and other components in that fleet. The natural professional life of such an expert is spent primarily as an intimate part of the most important element of his fleet, the battleship; and his knowledge of other units is gained largely through association. In a similar manner the officer in command of the naval air forces of a fleet must, for maximum efficiency, live his professional life with them and gain his knowledge of the tactics of other units through association. The "navigator" and "seaman" phrase of the above quotation is a bit far fetched. While aerial navigation and seamanship have certain fundamentals in common with those of surface craft, the details are decidedly and uncommonly different. In point of fact a competent aerial navigator would have little difficulty in getting along on a surface ship, while the reverse is far from true. Seaplane seamanship is common to surface craft seamanship in that both types move over the water and anchor to the bottom, and about there it stops.

"This means a sea training of years." How many years? About one life time of years with no spare time in it for aviation work! Naval aviation officers who have reached the higher grades need a "naval air training of years," in just as great a degree.

The other items quoted above can be mastered by an aviator working with and from ships of the fleet and *with his aircraft* and they cannot be mastered in any other way.

To quote Admiral Moffet from the *Army and Navy Journal:*

The training of a naval aviator must be based on a knowledge of the sea and of the ships which form the backbone of the Navy, otherwise naval aviation cannot attain a full measure of usefulness. With this end in view,

the policy has been evolved which requires of student pilots that they serve at least three years in the fleet after graduation from the Naval Academy before they are eligible for flight training. This wise provision takes cognizance of the fact that the men who take the air from the deck of battleship or airplane carrier are an integral part of the naval organization, and as such must have a full knowledge of the workings of the organization which they serve. . . . The aerial scout must be grounded in strategy and tactics if he would be an efficient aid to the commander-in-chief; the aerial spotter must have a thorough understanding of the principles of naval gunnery if he is to work in harmony with the fire control organization; and likewise the pilot of the torpedo plane and the bomber must know the vulnerability and defensive capabilities of his target. . . . . All of this is aside from the fact that the base of operations for the naval aviator is the ship, his home and his workshop, and thorough familiarity with it is essential.

All of which is true, yet all of it can be met to a sufficient degree by: (1) primary naval education; (2) two or three years sea duty prior to entering aviation, and (3) aviation duty within the Navy at sea and on shore.

Lieutenant Commander Herbster in the PROCEEDINGS states the Navy viewpoint on this question clearly and concisely:

The fact that naval aircraft operate in a medium of air cannot overshadow an equally true fact that naval aircraft must operate over the medium of water. The sea must always be taken into consideration in all the problems and employment of naval aircraft. Naval aircraft, therefore, whether employed from carriers, from ships or from fleet bases must be designed for sea work, and employed for sea work.

When such discussion is carried into further details, setting forth that aircraft design problems and similar matters are fundamentally different, it soon becomes a mere utterance which will not bear detailed analysis and is a weak link in our arguments for naval aviation for and of the Navy.

Lieutenant Fairlamb in the March, 1925, issue of the PROCEEDINGS has offered the following food for thought:

The real issue involved is simply this: Shall aviation be given a free hand to develop most quickly to its maximum efficiency along the lines and theories of those who are in it and therefore know best its possibilities and its limitations, or shall it be hampered in its development and be made to conform to the theories of those who are only with it? Assuming that people in aviation know what the people with aviation want and expect of it, is it not reasonable to expect better results if the former handle it with minimum interference? Yes, it seems reasonable in theory and the assumption on which it is based seems sound. In practice, however, it would not

be so ideal as many think, for the reason that there exists a diversity of opinions and theories among the people in it. . . . . At present there is no sharp dividing line in the handling of these items, as there is in the Marine Corps, which, though a part of the Navy, is an autonomous unit. All of the above matters are handled in the "part and parcel" manner, and the method is unsatisfactory to both the air navy and the surface navy. . . . . Otherwise, there would not be the changing sentiment swinging toward the independent air force. When from experience in working in double harness aviation feels that it is being hampered and held back, it is no wonder that there is the desire to strike out boldly on its own, and this in spite of the excellent arguments recently advanced by Captain Johnson and Lieutenant Commander Herbster who detailed in the clearest terms the folly of an independent air force. If we do not soon find a workable scheme for coordinating the development and operation of naval aviation with our normal service activities, we will surely fall before the attacks of the independent air force adherents. . . . . As between the material and the purely personnel aspect of aviation, though the former is a great factor in causing dissatisfaction, the latter because of the personal equation probably contributes to it more. I refer to the attitude of senior officers in particular and all officers in general toward naval aviation personnel. There are a large number of highly intelligent and capable ex-reserve officers whose principal naval experience has been confined to flying. To expect them overnight to be salty and seasoned watch officers, navigators, etc., is unreasonable. In passing the examinations for their respective ranks they have shown not only loyalty to the Navy, but the necessary mental capacity for becoming good officers and seamen as well. They should be judged and assisted accordingly in their professional careers afloat. There is a tendency also on the part of the service at large to doubt the good faith of Naval Academy men who have entered aviation. A classmate of the writer's, who went to a certain catapult ship as aviation officer, was made to appear as the ship's "politician," and treated accordingly, denied opportunity to fly his ships and hampered in his work. He disgustedly stated that naval aviation was hopeless until the older crowd passed on. This was not an isolated phenomenon. It is an illustrative case in point, and many others could be cited. . . . . It is of paramount interest that all officers in the service and particularly those of flag, command and executive rank, consider aviation units in their command as much a part of ship armament as their batteries and fire control installations. If this attitude is shared by all hands, greater harmony and cooperation must result and one of the best arguments for an independent air force at once loses its punch. The questions centering around the actual control of material, operations, personnel, and the other powers of the Bureau of Aeronautics are still debatable, but certainly the attitude to be taken by the surface navy toward the air navy is not. . . . . Failure on the part of the surface navy properly to appreciate the air navy and to cooperate with it will disaffect naval aviation personnel to the point where it will be forced to chose between casting its lot definitely with a united air service or with the Navy. There remains a possible alternative which we

have discarded once: viz., a naval flying corps similar in organization and administration to the Marine Corps, but that is a question for the suggested conference. In any case we must evolve a satisfactory scheme for providing maximum naval aviation development and coordinating it with the Navy.

It is extremely difficult to grasp and more so to describe the present attitude of the fleet towards aviation. Personally, from experience on the recent Hawaiian cruise, I believe:

First.—That the definite place of aviation in the fleet is entirely recognized.

Second.—That individual commanding officers and their seniors universally demand and insist upon the aircraft service which they know is of value to them, primarily spotting.

Third.—That many officers are at this time lukewarm toward the other phases of fleet aviation. They "don't want to be bothered" with fighting planes, air scouting, and the like. It is true that base patrols and auxiliary services have been widely used but possible aircraft functions prior to and during a major action are not receiving sufficient thought.

Fourth.—Through lack of experience, aircraft units are misused in operations and weekly and annual employment schedules are frequently based on erroneous assumptions and are not sufficiently progressive. At times, the impression, probably wrong, exists that aviation shall not be permitted to gain strength and efficiency in the various phases of its work; and that it shall proceed along very narrow lines carefully watched and directed at every turn. In gunnery exercises, employment and other matters, the feeling makes itself evident that aviation must "do as it is told" and that aviators are ignorant of the "broader phases" which must be considered in plans for the future. People in aviation cannot but resent unsound or unfair decisions based on a lack of understanding of those same "broader phases" or upon actual ignorance of the situation or existing conditions. The feeling that naval aviation can possibly develop as a menace to the Navy is absurd. Naval aviation is a part of the Navy and any gain in strength or efficiency on its part is a direct gain in our naval strength. Are we all in the United States Navy or are we not?

As Commander Vroom, in the PROCEEDINGS of January, 1925, states, aviation needs "the active support of an arm that appears to receive the same amount of consideration that the submarine did in its early development." The truth may be stated in the

fact that many naval officers having "seen" aviation are beginning to think that they "know" it.

Assuming that some change in the status of naval aviation commissioned personnel is necessary, there appear to be three possible forms of organization:

1) A Naval Flying Corps similar to the Marine Corps. A recent issue of the *Army and Navy Register* gives a synopsis of a bill forming such a corps, which, it is understood, will be introduced before the next Congress. [*Now in session.*]

2) Assignment of officers to aviation duty only. There are several forms which this alternative may take.

3) Continuation of present policies.

The primary principle involved, to my mind, is recognition of the fact that naval aviation presents a specialized permanent career for those officers who desire to follow it, and that positions of responsibility in naval aviation shall be filled by such officers, who because of their experience are best qualified for them.

A Naval Flying Corps may be entirely successful and on the other hand may involve much additional expense, and finally become entirely unsatisfactory to the Navy at large and to the aviators themselves. Success or failure will depend entirely upon the provisions of the laws governing such a corps and the manner and efficiency of administration and operation. To my mind any provision must provide for retirement at an early age of the less desirable.

Continuance of present policies even with the tacit understanding that officers may remain in aviation duty indefinitely if they so desire is most undesirable in that no stimulus is provided for aviation personnel. On the other hand it virtually provides a privileged class within the Navy and as in the probable case of a Naval Flying Corps would provide no means of eliminating those below the average in ability, while the more capable younger officers would avoid aviation, because of its insecure future.

Permitting officers to be assigned to aviation duty only on their own request after a certain term of satisfactory aviation service would also accept the sheep with the goats in the higher grades. In the February, 1925, issue of the PROCEEDINGS, Captain M. G. Cook has made a very excellent suggestion, that of selection for aviation duty only. Some such plan appears to be essential. I would suggest:

a) That officers be chosen for aviation duty as at present, i.e., after two years at sea and upon their own request.

b) That the "aviation cruise" be as long as possible but that it be sufficiently short so that officers can return to general line duties upon completion of it without any considerable handicap in carrying them out. Opinions as to the length of the aviation cruise will doubtless vary from two to eight years.

c) Upon completion of the "aviation cruise" select officers for "aviation duties only." Those not selected to return to general service duties.

d) This may result after some years in a greater number of officers for aviation duties only in the grades of captain and commander than are required. This argument has frequently been advanced in opposition to a Naval Flying Corps and to a United Air Service. I personally fail to see that the proportionate number of positions commensurate with these grades is not approximately the same in naval aviation as it is in the rest of the Navy. A detailed analysis made on basic war plans will show definitely the truth or fallacy of this statement.

At present a considerable shortage of naval aviators exists in all grades, but most particularly in grades above that of lieutenant. Also as officers remain in aviation for longer periods of time, their chances of serious accident increase proportionately. It seems quite possible that the situation will care for itself. Aviation is capable of a tremendous and rapid expansion in case of war. For this reason alone a slight peace time excess in the higher grades seems desirable. However, if thorough analysis shows that selection for "aviation duty only" as suggested above will provide too many officers in grades above that of lieutenant, I would suggest selection "out" to reduce each of the senior grades to the number desired with a provision for retired pay based on length of service.

There are four other matters affecting naval aviation which are worthy of discussion and which are of major importance but concerning which the "aviation attitude" may not be well known, or the true situation generally appreciated. These are:

1) Flight pay.
2) Naval Academy aviation training.
3) Enlisted pilots.
4) Morale in aviation.

1) Any argument for abolishing flight pay shows a total lack of understanding of aviation; is decidedly unjust from a standpoint of the risk involved; and cannot but place a breach between aviators and those proposing such a change. Precedent is a strong thing. The average man accepts abnormal risks in business and otherwise, primarily for the hope of immediate return in reputation, cash, or position. Aviators feel that any movement to abolish flight pay is founded on jealousy and ignorance, and that it is entirely unjust. Any alternative proposal such as insurance is a sop to those who in principle object to flight pay and to those who accept it.

2) Aviation training at the Naval Academy will produce two highly desirable results. It will increase the knowledge of aviation throughout the service and will probably result in a higher percentage of applicants for aviation duty after the required period at sea. The idea which possibly may exist among laymen that all midshipmen will now, upon graduation, or shortly thereafter, be qualified and experienced aviators, is most erroneous. In fact, were time and material available properly to train them it is probable that only about 25 per cent would pass the physical examinations and the flight schools. If more applicants for aviation duty are received, and they are very badly needed, the effort will be well worth the candle. A general knowledge of aviation among all naval officers, *coupled with proper understanding,* is also desirable. It must not be forgotten that a little knowledge is extremely dangerous.

3) Among the aviation pilots of the Navy are some very excellent and thoroughly experienced men from a flying standpoint. When such experience is backed up by years of detailed association and work with airplanes and engines, this practical flying experience is of much greater value. Aviation pilots have a very definite place in naval aviation. The "aerial chauffeur" idea which exists in the minds of some individuals, of all naval aircraft being manned by aviation pilots with *"qualified commissioned naval observers"* will be scouted as vigorously by aviation pilots as it will be resented by naval aviators. It discloses a complete lack of knowledge of aviation organizations and utter ignorance of the requirements and responsibilities of a naval aviator. It is further in direct contradiction to the "naval tactician, navigator, and seaman" argument.

4) "Morale" is a very elastic and perhaps overworked word. Nevertheless, in aviation, performance and results rest primarily upon the individual. There are few checks upon the performance of an aviator other than intuition of superiors based upon much experience and thorough association and familiarity with those individuals comprising the unit. In aviation, it is not only essential that leaders lead by virtue of rank and age, but that they lead through experience and knowledge and by their every-day work and actions. "Morale" in aviation is *the* primary fundamental. One cannot order and direct pilots to carry out scheduled work with the precision with which battleships execute fleet maneuvers. Too much rests upon the decisions and intelligence of the individual. Without confidence in their superiors, respect for their organization, a strong desire to progress and a keen personal interest in their particular phase of aviation, the subordinates of any aircraft unit are bound to be dissatisfied, discontented, and inefficient.

Some change in the present status of naval aviation personnel is most essential. The form that any reorganization may take is of little moment and *will probably fail unless every detail is carefully worked out and established along proper lines by the enacting law.*

DIESEL-ENGINED WARSHIPS

By M. F. Gunning, Naval Constructor, Royal Dutch Navy

Editor's Note: Submitted in the Prize Essay Contest, 1926. Although not awarded the prize or honorable mention, the article was considered so important by the Board of Control that it was decided that it should be published in the Proceedings.

EVERYONE following the triumphant progress of the Diesel engine must be struck by the great difference in the rate in which it is being adopted by the mercantile marine and the navy. While in some countries more than half the merchant tonnage laid down is propelled by internal combustion engines, all the naval vessels are still steam-driven, with the exception of submarines and a few auxiliary craft.

The reason for this is clear: the marine Diesel motor, developed on slow cargo steamers, where low revolutions are of paramount importance, has grown to be a heavy, ponderous engine, of undoubted reliability, but of great weight and enormous dimensions. Increase in power is obtained by very slow degrees, and at the cost of still greater weight and size. The introduction of double-acting engines has given but little improvement; every Diesel engine of considerable power yet constructed is totally unsuited for naval use, which is not surprising, since the requirements for a naval vessel are fundamentally different from those for a merchantman. The former wants a sprinter, the latter a stayer.

In these days of rapid progress it is very dangerous to predict that anything will be technically impossible in the future, and it is in no way intended to deny, that it may be possible at some future date to produce an engine, that will fit in below the armor deck of some capital ship or cruiser, that will not exceed the very narrow limit of weight available, and that will develop some 30,000 H.P. or more. However, if this engine is to be reliable, it will have to be evolved from motors that bear no resemblance to it whatever, usually a slow and tedious process, that may well be expected to extend through many years.

Rather than speculate on some more or less distant future, it is proposed to investigate what may be done now. As no capital ships will be built during the next years, we must look for an installation suited for a cruiser, or possibly an aircraft-carrier. This limits the height of the engine to about 15 feet, while a power far in excess of anything yet produced will be necessary on a minimum weight. It is evident that we must turn our attention to fast-running engines of the submarine type, in combination with some form of gear or transmission, which will enable us to use several motors on one shaft.

The biggest submarine engine yet fully tried out in practice is the 3,000 B.H.P. ten-cylinder M.A.N. engine, used on the *U-142* and her sister ships. After the war a great number of these engines were available, and many were fitted in merchant vessels running at reduced revolutions and power. They have been doing steady work for several years now, and have given full satisfaction. At present a 6,000 B.H.P. engine seems well practicable. A motor of this power has an overall length of 44 feet, 6 feet breadth, and 11 feet height above center shaft. It develops normally 5,000 B.H.P. at 350 revolutions, and can be forced to 6,000 B.H.P. by supercharging. There are 10 cylinders of about 26 inches diameter and 24 inches stroke (See *Jahrbuch der Schiffbautechnischen Gesellschaft* 1920, page 318 ff.). According to press reports Sulzers are constructing a six-cylinder 7,000 B.H.P. engine, of which no further details are published. By using twelve or sixteen of these engines from 70,000-110,000 B.H.P. would be available, the difficulty being to gear these engines onto three or four shafts.

Technically three types of transmission have been tried out, viz. the direct gearing, the Diesel-electric drive and the Diesel-hydraulic drive. The first named has given excellent account of itself on two cargo carriers, the *Havelland* and the *Munsterland,* in connection with the 3,000 B.H.P. submarine engines mentioned above. Recently an intermediate liner, the *Monte Sarmiento,* has been put into commission, and her sister ship, the *Monte Olivia,* will follow shortly. These vessels have twin screws and are propelled by four motors of 1,750 B.H.P. each, each shaft being driven by two engines. The gears are protected against the uneven turning-moment of the engines by heavy flywheels, calculated

to keep the period of vibration well away from the service speed of the engines.

The Diesel-electric drive is well known, and needs no further description.

The Diesel-hydraulic drive implies the use of the Vulcan hydraulic coupling. This very simple device consists of two sets of scoops fixed on the motor shaft, with a loose sleeve between. This sleeve is free to turn on the shaft and is in no way connected with it; it carries two corresponding sets of scoops, and between them a gear pinnion, which meshes with the pinnion mounted on the propeller shaft. The sets of scoops are enclosed in two casings which can be filled with oil, and one of which is provided with fixed guide-blades between the scoops. The oil is set in motion by the scoops mounted on the motor shaft, and carries the secondary scoops along, there being practically no slip. The fixed guide-blades serve to invert the motion of the oil thrown from the primary scoops; in this way reversal of motion is possible independently of the engines, by emptying one casing and filling the other. When both casings are empty there is no connection between propeller-shaft and motor. The coupling absorbs the vibration of the engines and transmits a perfectly even turning-moment, so that the gears work under the same conditions as in turbine-driven vessels.

Full-scale trials on the M.S.S. *Vulcan* (2,000 tons dw.) and *Duisburg* (9,500 tons dw.) have shown that it takes only eight to ten seconds to reverse from full speed ahead to full speed astern, and that the efficiency is as great as 97-98 per cent. These figures have been confirmed in actual practice. Up to now ten vessels have been, or are being fitted with this drive, totalling about 20,000 B.H.P. and 60,000 tons dw.

The direct gearing is not considered suitable for naval work. In order to develop sufficient power it would be necessary to connect three or four engines to one shaft: to start and reverse these engines at the same time would raise insuperable difficulties. Furthermore any small trouble on one of the engines would put a whole shaft out of commission, while a major breakdown (e.g. if a piston seizes), would probably cause the fracture of a shaft or the destruction of the gears. Another disadvantage lies in the fact, that it is not possible to stop one or more engines, when less than full power is wanted.

Between the electric and the hydraulic drive there is in many respects not much to choose, as both have all the advantages of the indirect drive. On the other hand, the Diesel-electric installation probably is heavier and certainly far more complicated. It is less reliable, especially in view of the heavy currents that have to be handled when reversing suddenly. From a military point of view it is more vulnerable.

The advantages of indirect drive, mentioned above, consist of:

a) Better protection and watertight subdivision.
b) Greater fuel economy.
c) Easier maintenance.
d) Greater reliability.
e) Better maneuvering.

(*a*) The indirect drive calls for a great number of small units, each installed in a separate compartment. The destruction of one will but slightly impair the efficiency of the rest. The athwartship dimensions of the engines being small, it is possible to adopt longitudinal bulkheads, because the filling-up of one compartment will not cause any serious list. At the same time excellent protection against poison gas is obtained.

(*b*) Fuel economy is most called for at low, "economical" speeds, when only about 10 per cent or less of full power is used. Under these circumstances the economy of a Diesel engine suffers greatly, mainly because of the lowered mechanical efficiency, and the fuel consumption is raised accordingly. In case of indirect drive one or more engines are disconnected and stopped. For instance, if a ship is run at half its trial speed, about one-tenth of full power will be necessary at one-half of the revolutions for full speed (roughly speaking). If four engines are connected to each shaft, three will be stopped, the remaining one delivering two-fifths of its full output at the reduced revolutions at nearly the same m.e.p. as it was designed for, and at which the best fuel economy is obtained. In case of direct drive, the engines, running at 10 per cent of full power, would have such extravagant fuel consumption, that it would be preferable to stop two or more shafts altogether, dragging the propellers idle through the water. This means a greatly increased resistance, waste of fuel, and consequently reduced radius of action.

(*c*) Generally speaking three big engines are easier to maintain than twelve smaller ones. This, however, takes no account of

the special conditions on warships, where space is cramped, where there is no high skylight, but an armor-grating or a protective deck right over the engines. Under such circumstances it is far easier to handle many light parts than a few heavy ones.

Also, on merchant vessels, the machinery is always running at full power, while in naval vessels it nearly never does; consequently, in case of indirect drive, small repairs, such as cleaning valves, and so forth, may be carried out while at sea on engines that are not in use.

As all engines would be exactly similar, a very complete store of reserve parts can be carried.

(*d*) If one engine has an x per cent chance of defect during a certain period, four engines will have, *ceteris paribus,* about $4x$ per cent chance. However, on the indirect-driven vessel, there will be in most cases but one engine running on each shaft, and this brings down the chance of breakdown to x per cent again. Also, there will be four engines on each shaft, any of which may be used, whereby the risk dwindles to x^4 per cent. Of course, this only holds good for cruising, but it is on long cruises that reliability is most needed. On full speed runs the advantage lies the other way. But full speed runs usually last but a relatively short time (at least on cruisers that are patrolling or raiding, and these are the only ones that need be taken into account, see below), during which period x and $4x$ are nil to all practical purposes, provided the machinery has been kept in good order. As we have seen, the indirect drive offers every opportunity for fulfilling this stipulation.

Another factor in favor of the indirect drive is the fact that the engines are slightly simpler, because they are not reversible, and are not subject to the brutal changes in temperature caused by expanding hot air in cold cylinders. In fact, in this respect they work under the same circumstances as stationary engines.

(*e*) In the indirect-driven vessel the number of maneuvers that may successively be carried out is not limited by the capacity of the compressed air reservoirs.

The hydraulic drive gives also the advantage of quick reversing; on the 9,500-ton *Duisburg* it took but nine to ten seconds from full speed ahead to full speed astern. This may be explained by the fact that only the inertia of the propeller, shaft, and gear has to be overcome, and the full power of the engines is available to do this.

With the electric drive reversing is more complicated and will probably take more time, especially in big installations.

It is rather difficult to form an opinion on the question of space, without a definite project of the vessel into which the machinery has to be fitted. Generally speaking, it may be stated that the athwartship and vertical dimensions of the engines proposed are small, and would present no special difficulties. On the other hand it is not improbable that the total length of machinery-space would somewhat exceed that of a corresponding steam installation. But length is the dimension the designer is least concerned with: an increase in length will lower the horsepower per ton displacement, will increase the metacentric height and stability, and will give more deck space, especially valuable on a vessel that will have to carry airplanes. It is true that it also causes greater ship-bending moments, and higher structural stresses. But a modern vessel is sure to have one or more protective decks against aerial attacks, which, if properly constructed, will give plenty of strength in the places where the highest stresses occur, viz., in the upper parts of the ship.

The all-important question of weight has been kept to the last. As no large installations have been carried out, speculations must be rather vague. The engines themselves need not weigh more than 40 pounds per H.P., this being the weight of a modern submarine engine, such as would be employed. The complete engine weight, inclusive of shafting, piping, etc., is about 80 to 90 pounds per H.P. on a submarine. The weight of a proposed high-powered installation is put at 73 pounds per H.P. To this must be added the weight of the gears and hydraulic couplings of which not much is published. On the other hand several factors tend to lower the weight, viz., the elimination of the major part of the compressed air vessels, auxiliary compressors, etc., and the fact that the weight per H.P. of shafting, propellers, piping, etc., is considerably lower in the bigger installations. Still it is not probable that the weight could be reduced below 100 pounds per H.P., and it is quite possible that it will exceed that amount. The weight of a corresponding steam-installation would be about 50 to 60 pounds per H.P. This seems rather hopeless for the Diesel drive, but the question changes considerably if we take the weight of fuel into account. For the same radius of action the Diesel-driven ship

would not be more than one-third* of the fuel of the steamship, which may have as much as 60 pounds per H.P. on board, giving 110 to 120 pounds per H.P. in total. The corresponding figure of the Diesel-driven ship would not be less than 120 pounds per H.P., so that, *if all assumptions are made in favor of the latter,* the question of weight would not seem to be an insuperable obstacle. It must be kept in mind, however, that this procedure cancels the principal alleged advantage of the Diesel drive; on the assumptions made, *the radius of action is the same as that of a steam-driven vessel.* Also for the "Washington cruiser" the substitution of engine weight for fuel is impossible, because the former is included in the 10,000 tons displacement and the latter is not. It can only be done on smaller cruisers, such as the proposed British B Class.

The matter assumes a different aspect if we allow a slightly inferior speed for the Diesel ship. Suppose a reduction of 2 knots, say from 34 to 32, is allowed. This means that but 75 per cent of the horsepower is needed: such is the price of speed.

The weight of the motor plant, estimated at 100 pounds per H.P. is reduced by 25 per cent, so that an additional fuel supply of 25 pounds pers H.P. is available; in other words, the radius of action is more than doubled. It follows that but a very slight reduction in speed is needed to obtain a big increase in radius of action, or to neutralize any excess of motor weight above 100 pounds per H.P.

In a modern steam-driven cruiser a large percentage of the weight of the equipped vessel consists of oil fuel, which is mostly carried in double-bottom tanks. When the oil is in, the center of gravity is low, giving a large metacentric height, which makes the vessel uneasy and jerky in its movements. When the oil is out, the opposite is the case: the vessel is tender and heels easily in a beam wind.

In a motor vessel the major part of the fuel is replaced by additional engine weight, which always contributes in the same

* NOTE: This fraction is considered justifiable, because at low speeds the steam engine will not run at its best economy, while the Diesel engine (indirect drive) will, because extensive waste-heat recuperation for distilling, etc., is possible, because all stand-by losses are suppressed and because the fuel consumption of a Diesel engine does not increase after a prolonged period of service in the same way that of a steam engine does.

way to the stability of the ship; consequently, in light condition, the center of gravity lies lower than in a steamship. Another factor tending to lower the center of gravity is the suppression of funnels and uptakes in the Diesel ship.

A low center of gravity allows a reduction in beam to be made, which is attended by a reduction in hull weight.

On a naval vessel deck space is scarce, especially since the introduction of anti-aircraft batteries and scouting planes. The Diesel drive will bring great improvement in this matter, because there will be practically no funnels and uptakes.

The steam engine, in its simplest form, consists of two inherent parts: the engine and the boiler. If either is damaged, the whole plant suffers. The matter is more complicated in a large installation, where there may be eight boilers and three or four engines, each in a separate compartment, but still the same principle obtains. It follows, that from a military point of view a Diesel-driven ship with twelve engine rooms, each with a self-contained prime mover, is to be preferred to a steamship with eight boiler and four engine rooms, because in the former case the filling-up of one compartment entails the loss of 8 per cent of the propulsive power, while in the latter case 12½ per cent or 25 per cent are lost.

In case of the indirect drive this does not hold quite true, because the destruction of the couplings would disable a shaft. However, the chance of a direct hit is small, and the mere filling-up of the compartment in which the couplings are situated would not cause much damage, as their working would not be impaired. In this respect the electric drive is inferior.

The reliability of the Diesel engine is regarded with much doubt by many practical men, especially by those who have had no actual experience with engines constructed after the war. Of course, the engine in itself is far more complicated than a turbine or triple expansion steam engine, the pressures, stresses, and temperatures much higher; the chances of failure seem multiplied. Still, the underwriters quote the same insurance premium (on casco and engines) for Diesel- and steam-driven vessels, so that in actual practice the reliability seems to be much the same. Of course, a lightly constructed, high speed, trunk-piston engine is more liable to defect than a heavy, slow-running one of the crosshead type, but the same difference exists between the machinery of a tramp-

steamer and that of a modern cruiser or destroyer. The steam plants on these vessels are not so very reliable at all. Only the failures likely to occur are so very familiar, that they are accepted as inevitable and, by a curious process of subconscious thought, left out of account. Many engineers seem less impressed by a leaky condenser-tube than by a broken valve-spring, although it may cause far more damage and trouble, simply because they are better acquainted with it.

It is easy to enumerate a few notable instances of machinery failure during the war, e.g., the disabling of the *Lion* by a leak in her feed-water tank and the *Queen Elizabeth* stripping the blades of one of her turbines at Gibraltar, while urgently needed at the Dardanelles. Also the tale of the German raiders is very instructive. Of these there were six: the *Dresden, Leipzig, Nurnberg, Konigsberg, Emden,* and *Karlsruhe.* Constant machinery trouble prevented the *Dresden* doing any "useful" work as raider, and delivered her, after a game of hide and seek, helplessly into the hands of the enemy. The *Leipzig,* at the Falkland Islands, was unable to run full speed, because her engines would not stand the strain. The *Nurnberg* would almost certainly have escaped (*vide* Nav. Op. I, p. 430) but for the fact that two of her boilers exploded at the beginning of the chase. Urgent repairs prevented the *Konigsberg* from raiding the Colombo-Aden trade route and forced her to lie up on the Rufuji River. The *Emden* reports constant boiler trouble. The *Karlsruhe,* having only just completed her trials, makes the best show. Still she had to lie in mid-ocean with stopped engines for two whole days, in order to carry out repairs, and her first officer reports that the services of a seaplane would have been invaluable, especially when the vessel was coaling or overhauling the engines.

It is difficult to see where the "undoubted reliability" of the steam engine comes in, and how on this account serious objections can be raised against the adoption of the Diesel engine, especially in view of the advantages of the indirect drive, stated above.

As we have seen, a Diesel-driven warship will, *ceteris paribus,* probably be slightly slower than a steam-driven one. In these days, when ever greater speed is claimed for warships, a new type of prime mover, which brings with it a decrease in speed, will stand a poor chance indeed. But in certain circumstances the steam-driven vessel is slower than her motor-engined rival,

and the advantage thus given to the latter may possibly atone for the lower speed she usually has. To speak plainer: the Diesel ship can almost at a moment's notice work up to full speed, whereas the steamer wants at least an hour to do so. It took the *Richmond* about one hour to work up from cruising speed to 30 knots (i.e., 4 knots below her trial speed) when she received the message of the forced landing of the *Boston,* and surely then if ever her boilers would have been strained to the utmost limit. In a Diesel ship the engines could have been started in a very few minutes indeed.

In war time this must be a valuable asset to a ship, especially a cruiser on raiding or patrolling duty. A scout, sent on a well-defined errand, can have her boilers ready by the time any need for full speed is likely to occur; a raider or patrol cannot do so, because of the enormous loss of fuel incurred. On a turbine vessel the commander is always faced with the dilemma: greater preparedness versus greater economy. In most cases a mean course must be adopted, and both suffer. The motor ship can always be run at its best economy, without impairing its preparedness in the least.

It is interesting to show numerically how great the advantage is, thus given to the Diesel ship. Suppose a Diesel-engined raider, with a maximum speed of 32 knots, is sighted at fifteen miles distance by a turbine cruiser capable of doing 34 knots. The raider will run away directly at 32 knots, while the cruiser, not having steam for more than, say, 20 knots, may, by forcing her boilers, succeed in doing twenty-five miles in the first hour of the chase. By that time the Diesel ship will be twenty-two miles away, and out of sight. The steamship now has a 2-knot advantage, but unless she is able by airplane scouting to find out the course her quarry has taken, and is not prevented by the raider's planes from doing so, she has little chance of finding him. If she can keep on his track, she wants three and a half hours more to reduce the distance to fifteen miles again; after four and a half hours of chase she is just about where she started, and at least another three hours of chase are necessary before an engagement is possible. The raider seems to stand a very good chance indeed of effecting his escape. If the condition of the sea makes it impossible to run at full speed, the advantage of the motor ship is greater still, as the difference in speed will be negligible and she will get a big start at the beginning.

In the opposite case, i.e., if the pursuer is propelled by internal-combustion engines, he can come to grips in less than an hour's time.

To resume the foregoing pages it may be stated that:

a) A Diesel-engined cruiser is technically possible.

b) The Diesel drive offers several advantages over the steam drive, e.g., better protection, greater stability, more deck space, greater radius of action.

c) A Diesel-engined vessel will probably be slower than a corresponding steam-driven one, this disadvantage being partly offset by the fact that the motor ship can always be ready for full speed without waste of fuel.

This article has been written from a technical point of view. While it has tried to show the advantages and disadvantages to be expected from the adoption of the Diesel drive, it is not intended to go into their relative importance, which is impossible without a clear conception of the service for which the vessel is intended. This is staff work, and beyond the scope of this article.

A treatise on Diesel-engine warships is not complete without some mention being made of the most recent development in this direction, viz., the cruising Diesel engine on a steam-driven vessel. According to press reports a Diesel engine is to replace the cruising turbine on the new British mine-layer *Adventure*, and one is also provided for in the design of the proposed 17,500-ton French cruisers. In itself the system has much to commend itself: a motor has a low fuel consumption; so for long-distance cruising one is fitted and the steam machinery is retained for high speed running.

The weight of the engine, etc., would have to be deducted from the fuel supply, and in this way a certain fraction of the gain is lost. We will assume that the vessel has an oil supply of 1,000 tons, and wants 3,000 H.P. to run at cruising speed. The motor will be of a sturdy type as it must be designed to run continually at full power without an overhaul, and will not weigh less than 150 pounds per H.P., or about 225 tons. This means that the radius of action is more than doubled on the assumption that the oil consumption of the motor is one-third of that of the cruising-turbine. If the radius of action is left unaltered, the gain in weight of fuel may be used for additional armor or ordnance,

but in that case the radius of action at full speed would be materially curtailed.

In any case it will be reduced by 22⅛ per cent, but this is probably a matter of minor importance, as in almost every case a large part of the cruise would be run at moderate speeds.

It would be interesting to know how the Diesel engine has been connected to the shafts. In this case the Diesel-electric drive seems to offer many advantages, as it leaves the designer a free hand in the placing of the motor, and it allows one engine to drive all the shafts, so that no losses are incurred by dragging idle propellers through the water.

Of the advantages of the Diesel drive not much remains. The watertight subdivision is not improved at all, the stability but little, and the ability to work up to full speed quickly is completely lost. If the vessel is running on the Diesel engine with the boilers out and the turbines cold, she will want at least three hours to set her steam plant going, unless the turbines are kept warm by the utilization of the waste heat of the exhaust gases.

The Diesel cruising engine seems only justified on vessels that go on long, but very definite errands, on which the time when full speed will be wanted can be predicted with certainty, that is to say, on exactly the opposite occasions from those when a full Diesel ship can be employed to advantage.

THE NAVAL OFFICER AS A PUBLIC SPEAKER

By Lieut. Comdr. George E. Brandt, U. S. Navy

THE purpose of this paper is to make clear to the reader the essentials of successful public speaking. There are certain elementary considerations a knowledge of which is necessary. Neglect these and you fall short of your possibilities. Far from being a complicated and difficult matter public speaking on the contrary is simple. An acceptable measure of ability is easy to acquire, and certainly is well within the reach of the average naval officer. It is assumed that public speaking required of officers has to do with the giving of information by clear statement rather than the entertaining with flights of oratory.

Some will say that it makes no difference whether a naval officer can make a speech or not. This is of course true in a measure, but it is also true that many opportunities are presented for a speech that might do a great deal of good. Furthermore, naval units have become so large that big meetings are oftentimes necessary. Then, too, these naval units are cooperating with patriotic, scientific, civic, and business interests to such an extent that the naval officer cannot with propriety decline invitations to make an address or to read a paper. He should be interested in the welfare of the country as well as in the efficiency of the Navy. Naval interests are sometimes closely related to civic affairs. At some time or another the officer attends a board of trade dinner or a business convention as an official duty. He must be ready to speak if required by circumstances. At such times it helps us little to maintain that we are fighters, not talkers.

Theodore Roosevelt reminds us that the success of our arms at Santiago was due to the earnest pleadings of patriotic and far-seeing men in Congress who years before insisted upon the appropriations which made possible the building of our fleet.

By no means the least necessary qualification of the successful naval officer, therefore, is that he be able to express himself clearly, briefly, forcibly. Our ideas, sentiments, convictions, and decisions are of little use unless we can impress them upon others.

As a matter of fact, it is comparatively rare to find a successful officer who is not at the same time a good talker. He is a good talker because as a rule he knows what he is talking about, and he is perfectly natural and unaffected. He is, at his best, with an audience of one or at the most a small group. Increase the number to fifty or one hundred people and his confidence often fails. He not infrequently halts, stammers, and makes an exhibition which is equally painful to his hearers and to himself. What follows aims to show that such an exhibition is unnecessary. Confidence is inspired by thorough and correct preparation.

The Speech on Paper.—There is a difference between preparing a paper to be printed and read and one to be spoken and heard. Readers dislike repetition and become annoyed when an idea already grasped is presented a second time even though it be in a different form. With hearers, however, this is not so. The successful speaker is the one who can express the same thought in different words. The impression is strengthened each time the idea is repeated. Daniel Webster used his knowledge of this with effective skill. It is related that an experienced clergyman gave the following advice to one of his younger associates, "In preaching a sermon there are only three things to do, first tell what you are going to say, second say it, and third tell them what you have said." The gentleman who made this remark recognized the value of repetition and also indicated the three essential parts of any paper or discourse—the introduction, the main subject matter, and the conclusion. Painstaking preparation of each of these parts is necessary; just as necessary for a speech to be delivered without notes as for one to be read. Careful thought should be given to every sentence and even every word. Extemporaneous speaking may be entertaining and instructive, but extemporaneous thought is a severe trial to the audience. In the great majority of cases sufficient notice is given that one is expected to speak. It is a duty both to oneself and to one's hearers to give careful preparation to what is to be said. A rambling speech is likely to please none but the speaker.

The Introduction—The purpose of the introduction is to get the hearer's interest, and whet his appetite for what is to follow. It is varied in its possibilities. Frequently it is sought to impress upon the hearer the importance to him of the topic to be presented. An excellent practice is to show the relation of subject and speaker

to the audience. A common fault is to make the introduction so long that it becomes dull and tiresome. Whatever else it *may* be remember that first of all it *must* be interesting. The best practice is to make introductory remarks brief or even to avoid them altogether when time is limited or the subject is already introduced. Try by all means to tie up the subject and the speaker with the audience. Do not begin with an apology. Do not belittle yourself by expressing doubt as to your ability to handle the subject. Do not make excuses for inexperience as a speaker. Do not minimize the importance of what you propose to say. Your shortcomings may not be suspected unless you advertise them yourself. There is a good reason for your being asked to speak. Those who have charge of the arrangements have confidence in you and you should do everything possible to justify that confidence.

The following are quoted as examples of appropriate introductions:

I wish to talk to you about Naval Strategy. Before plunging too boldly into the subject, let us consider two or three related ideas.[1]

As a Congregationalist, as well as a Naval officer of many years' service, I feel it not inappropriate to discuss with churchmen the great question of naval disarmament.

The Christian people of America should strive to put an end to war. But how? . . . .[2]

The last quotation is an excellent illustration of tying up the subject and the speaker with the audience. Be careful of the funny story as an introduction. Give your audience a chance to get acquainted before assuming the intimacy thereby implied.

The Main Subject Matter.—The first requisite of any speech or writing is a definite and precise plan. Before we can transmit our ideas to others we must first know exactly what we want to say, what points we want to bring out, what is to be emphasized, and what is to be explained. The approved practice is to make an outline. Write off each principal heading, leaving space for subheadings under each. Now write the subheadings in sufficient detail to indicate at a glance every point you wish to bring out under each heading. When this is done the probability is that you will find a good deal of repetition. The task now is to eliminate repetition and regroup the subheads in the best order. Strive to be logical, coherent and simple. A few points presented in

[1] Rear Admiral Schofield, U. S. Navy, "Naval Strategy."

[2] Captain Overstreet, U. S. Navy, "Danger of Disarming America."

logical order, skillfully connected to form a complete whole, and free from outside matter, will be more effective than a large number of points merely mentioned or confused with side issues. Keep to one subject. Seek to drive home one main idea. If you feel that the subject requires the consideration of many points they might be grouped by classes and emphasis put upon the classes rather than upon the individual points.

The outline is worth the most careful preparation that can be given it. If it is well constructed and thoroughly developed the speech is practically written. Proceed now to build upon the outline keeping close to the path you have marked out. As you write thoughts will come to you which you recognize as effective or clever, stories suggest themselves, you are tempted to digress for effect; do not be carried away from the plan as set down. Make these new thoughts fit into the plan in their logical place or discard them. Thus only will you make your ideas understood.

The speech is worthless unless you make others understand you. You must be so clear that the audience recognizes each point when it is made and sees the relationship to the whole as the theme develops. The plan must be evident. An important difference between what is intended to be read by others and what is intended to be heard by others is found in the manner of indicating the plan. In a piece of reading matter the structure is indicated by headings or paragraphs. The speech has none of these aids, the speaker cannot announce paragraphing and punctuating. These must reveal themselves. The speaker must be conscious of the plan and must either directly or indirectly convey it to the audience. Make the passage from one point to another easy, and natural. Each point should grow from what has gone before. Changing abruptly from one thought to another leaves the hearer confused, and he is apt to loose the thread of the discourse. Once lost this thread is picked up again only with difficulty. Few will make the necessary effort. In a speech the transition from one point to another must be indicated more boldly than is necessary on the printed page. It must be clearly recognized by the audience. Clearness is promoted if we use the simplest words and avoid involved sentences. The speech must be understood else its object is defeated. Unusual words like long sentences tire the hearer. Attention is apt to be diverted to the possible definitions of a word.

The Conclusion.—If you have followed a definite plan as above outlined, you will know when to stop, because you will know that all the points you wish to make have been brought out. It remains only to clinch your remarks. Probably the best conclusion is that which follows the advice previously quoted, "Tell them what you have said," provided that you make it brief and emphatic. In reference to "clinching" the following story is told by the late Donald Sage Mackay who enjoyed an enviable reputation for splendid oratory:

> I had recently graduated from the theological seminary, and was sent among the hills of Scotland to preach. Of course, I was filled with my own importance, as I imagined myself about perfect in theology and oratory. I prepared what I considered a splendid sermon, and went to the kirk determined to astonish my hearers. The services passed off smoothly, and at their conclusion several of the ladies came up and told me how beautifully I had done, which, of course, only increased the amount of self-satisfaction with which I had delivered the sermon. Finally a kindly old Scotchman came slowly toward me, took me by the hand, placed his other hand upon my shoulder and said: "Well done, well done, but ye didna clinch it, my lad, ye didna clinch it." This did me more good than all the praise of the dear ladies, and from that time forth I always aimed to "clinch it."

The speaker should sit down while he has the audience well in hand. When the time for the conclusion is reached there is a momentary increase of attention, now is the time to bring your remarks to a swift emphatic close. Stop when you are through.

DISCUSSION

Post-Treaty Naval Design

(See p. 316, February, 1926, PROCEEDINGS)

HECTOR C. BYWATER AND MAURICE PRENDERGAST.—Our essay was written with no other purpose than to present the characteristics of a French design, which, for the sake of convenience, we called the *Indomptable*. This suggested type of fighting ship appeared to have possibilities of some interest from the strategic and tactical points of view. It did not occur to us that our remarks might, in the least, deflect American opinion from the sound doctrines of man-of-war construction.

Commander E. G. Allen, U. S. Navy, has read into our essay a meaning that it was never intended to bear. Discussion on technical questions of naval interest can surely be conducted without arousing suspicions of national bias or ulterior motive.

Apart from the unfair, implication of malice prepense, what is Commander Allen's main line of argument? We trust that the following outline presents an impartial summary of our critic's observations:

1. He divides navies into "Blue Water" and "Regional Defense" organizations, and points out that the United States Navy is essentially a "Blue Water" force.
2. He expresses his belief in the classic "Blue Water" creed, of the concentrated fleet seeking decision by a major sea action. In his opinion, "the full-dress naval battle" is the cardinal event of naval warfare, and all ship-types should be correlated to that decisive event.
3. Discussing major fleet actions, he considers the concept that such battles will be invariably decided by the opposed fleets fighting on strictly parallel courses to be an assumption unwarranted by past history, and an improbability in the future. On these grounds, he condemns the gun-distribution of the new British *Nelson* class battleships.
4. He turns to the "approach period," just before a major fleet action, and points out that the United States battle fleet would be seriously handicapped through its lack of battle cruisers capable of acting as supports to the advanced scouting line.
5. He considers the value of a multi-function vessel (battle cruiser *plus* aircraft-carrier) during this "approach period," and concludes that, in the phase immediately preceding a general fleet action, such a vessel would have little practical worth. He considers that air naval attack, by means of bombing aircraft, rests on an inherently weak basis—the aircraft-carrier. Further, he declares that aircraft spotting, built up on

the erroneous assumption of parallel fleet course in battle, is of no practical worth.

6. Finally, under the tonnage replacement rules of the naval treaty, he urges that battle cruisers should be built for the U. S. Navy.

Now all this argument is erected on a purely "Blue Water" foundation —the concentrated fleet, and the decisive sea battle. The *Indomptable* is a vessel based, not on the acceptance, but on the entire rejection of "Blue water" tenets. Her design is founded on the fundamental argument of the Continental "Jeune Ecole," that an inferior fleet should not attempt, or even consider, the decisive sea battle. These "heretics" declare that the concentrated power of a superior "Blue Water" fleet can—and should—be broken up, by intense commerce war, waged by a new and very powerful type of ship, partly battle cruiser and partly aircraft-carrier—in short, a super-corsair.

The *Indomptable* is not a ship for a "Blue Water" navy, and Commander Allen's consideration of the design on that basis is entirely beside the point. It is as if he had looked over a racing auto, and then declared, "this thing is no use as a steam roller." We never advanced the view that the fast and light French commerce destroyer was suitable for the "Blue Water" conception of "steam roller" naval strategy. What we did suggest was that if it came to a chase the "Blue Water steam roller" would have some difficulty in hunting and cornering the French "racer." Whether the "Blue Water" (or Classical) school of naval doctrine is right, or whether the heretical, "futurist" views of the "Jeune Ecole" are correct, is a subject which can be debated *ad infinitum*.

Incidentally, Commander Allen, when discounting the aircraft-carrier, says that the value of aircraft bombing and air spotting is much over rated. But when treating of the "approach period" just before a main fleet action he entirely ignores the value of the aircraft carrier in assisting advanced reconnaissance. He wants battle cruisers to act as supports for the advanced scouting line. In August, 1916, the British grand fleet had battle cruisers, acting as supports to such an advanced screen. It was the superior fleet, but it just failed to get contact and the decisive fleet engagement that it sought. Why? The cause of failure was during the "approach period." The German high sea fleet was so well served by its airship scouts that it succeeded in avoiding action. We do not deny the validity of the argument that the United States Navy requires battle cruisers. We wish to point out that such ships are no infallible guarantee that the superior fleet will get contact and action with an inferior fleet, when the weaker force is well served by air reconnaissance.

So much for Commander Allen's criticisms in principle. Turning to his strictures in detail, his objections to the *Nelson* class of battleships and their peculiar arrangement of guns would, doubtless, be endorsed by not a few British naval officers. It must be remembered that these two battleships were designed at the instance of officers who have had first-hand experience of squadron tactics and naval warfare. Whether the *Nelson* class

accurately interprets that experience is another matter. Commander Allen is correct in his conjecture that these two battleships are "arrow-head ships," for a British First Lord of the Admiralty has described the *Nelson* and *Rodney* as "the Spearhead Ships of the British Navy."

Reverting to the *Indomptable*, Commander Allen thinks a 12-inch armament superfluous in a vessel designed for commerce raiding, suggests a battery of "at least four 6-inch guns astern," adding that, "if built to polish off the 10,000-ton, 8-inch cruiser, the same arrangement would be required ahead." May we inquire how a ship mounting 6-inch guns is going to "polish off" a cruiser armed with 8-inch guns? (The *Monmouth* certainly did not "polish off" the *Scharnhorst* at Coronel.) Our critic speaks of Great Britain and Japan as "possessing battle cruisers armed with 16-inch guns." We have not heard of these, and we will warrant that Commander Allen, on further search in reference books, will not find them. The only battle cruisers known to be in existence today total eight, divided as four to Great Britain and four to Japan. Of the four British units, three are armed with 15-inch guns, and one with 13.5-inch; the four Japanese ships are all armed with 14-inch guns. The naval treaty prohibits rearmament of capital ships with larger guns.

Finally, Commander Allen considers that "the United States should attempt to get to sea a division of ships, with at least 35-knots speed, mounting a battery of 16-inch guns in the conventional, center line disposition. . . . ." It would be interesting to hear how ships such as these—more powerful than the British battle cruiser *Hood* of 41,200 tons—could be built within the treaty limit of 35,000 tons (standard) displacement for capital ship types.

Captain E. F. Eggert (CC), U. S. Navy, offers some interesting technical criticisms. But, before dealing with these, may we point out that both Captain Eggert and Commander Allen have, apparently, overlooked the strategic motive which underlies the *Indomptable* design? Such a vessel would, in our opinion, have a three-fold mission to perform:

1. To hunt down and destroy cruisers of the 10,000-ton "treaty," and smaller types.
2. To prey upon commerce, by destroying entire convoys or individual mercantile vessels; also, to demolish ill-defended over-seas naval stations, fuelling bases, etc.
3. To compel the enemy to dissipate his capital ship strength by forcing that opponent to send dreadnaughts in chase of a raider which could only be overcome by dreadnaughts, or battle cruisers.

The efficient execution of these three functions calls for (a) great speed; (b) a gun-armament decisively superior to that of the 10,000-ton treaty cruiser types, and (c), a moderate amount of protection—for all of which the *Indomptable* design provides. Opinions may differ whether the *Indomptable* would be a sound investment; but there is little doubt that ships of this species would introduce a very embarrassing factor in the strategical calculations of a great naval power—especially if that power lacked battle

cruisers. So much is admitted by Commander Allen. The *Indomptable*, as we see it, is essentially a type that would commend itself to a secondary naval power, weak in dreadnaughts. For the British or the U. S. Navy its value would be problematical.

Captain Eggert's objection that the *Indomptable's* speed of 34 knots is inadequate to qualify her for pursuit of modern cruisers, is quite relevant. Such is the speed mentioned in French forecasts; it may be that a higher velocity is actually aimed at. But a sea-speed of 34 knots is perhaps superior to that of any cruiser now afloat. The new French 10,000-ton cruisers (*Duquesne* class) are designed for 34 knots; the new Italian cruisers, of the same displacement, are supposed to have a speed somewhat in excess of 34 knots. The Japanese 10,000-tonners (*Nachi, Myoko, Ashigara, Haguro*), are reported as being designed for 33.6 knots on normal draught, but only for 32 knots on deep load.

The British battle cruiser *Renown* is nominally a 31.5-knot ship. It is quite legitimate to suggest that the *Renown* might have the good fortune to come upon the *Indomptable* while the latter ship was busy with a prize, or fuelling, or under cover of darkness. But the aircraft with which the French ship is equipped would, to some extent, safeguard her against such a surprise. If the *Renown* did get within range of the *Indomptable*, it does not follow, under the chances of war, that the French ship would be inevitably doomed. In August, 1914, the *Karlsruhe* got completely away from the *Suffolk* and *Bristol*, although chased by both British cruisers. At night, the *Bristol* ran the range down to 7,000 yards, and entirely surprised the *Karlsruhe;* yet the German ship effected her escape. The *Renown* is not a strongly armored ship, and might suffer severely from the long-range, high-powered guns of her antagonist.

If France should build ships of the *Indomptable* class, what constructional *riposte* could be made against such a type? On the principle that "to every action, there is re-action" there could only be one outcome. The navies threatened by the *Indomptable* would reply by building ships, bigger, faster, more heavily armed, and better protected, than the French creation. We have attempted to outline the salient details of a "Contre-Indomptable"—a ship with sufficient superiority in speed, attack and defense, to ensure the destruction of the French super-corsair. But Captain Eggert states that on technical grounds our suggested "Contre-Indomptable" is not a practical possibility. Inasmuch as he is an officer of the Construction Corps, we must accept his expert ruling. May we ask him if, under the naval treaty rules, no warship-type can be created capable of destroying, with positive certainty and a reasonable degree of impunity, a ship of the *Indomptable* type? The French project only envisages a ship of 17,500 tons—that is, a half-unit, as compared with the naval treaty unit—the capital ship of 35,000 tons. Other navies, when drafting plans for their replies to the French ship, would have at their disposal 17,500 tons over and above the *Indomptable's* displacement before reaching the treaty limit-mark of 35,000 tons. That generous margin they could use for enhanced gun-power, speed, or protection. Does Captain Eggert say that, when a 17,500-ton design can

be countered by another design ranging up to 35,000-tons, the larger ship cannot be better armed, better protected, and faster, than an adversary only half her size? If a 35,000-ton "Contre-Indomptable" cannot be created to destroy a ship only half her size, then the resources of naval architecture must be bankrupt. If you cannot catch and kill the big French raider, then you are at her mercy.

In suggesting a 14-inch armament for the "Contre-Indomptable," we had in mind the long 14-inch, with a large degree of elevation, and should have made this clearer. The details of the *Indomptable's* 12-inch guns were extracted from French descriptions of the design. Those guns appear to be an improved mark of the French 1906 model. In the official French Naval Ordnance Table, published in *Jane's Fighting Ships, 1925* (p. 148), the 1906 mark of 12-inch gun is listed with a projectile of 960 lbs. weight.

Touching upon post-treaty naval design, we would again lay stress on the point that, when the naval treaty was framed, France and Italy, by express provision, reserved the right to use their quota of capital ship tonnage as they pleased. In these two countries the doctrines of the "Jeune Ecole" are becoming predominant. This school of thought considers the huge battleship and battle cruiser types to be already moribund; for such ships they consider their navies will have no further use ten years hence. We do not share these views, but here express them as indicative of current Franco-Italian naval thought.

The French have proposed the *Indomptable*—a super-corsair, partly a battle cruiser, and having, in part, the vehicular capacity of an aircraft-carrier. In our essay we tried to show that the provisions of the naval treaty relative to aircraft-carriers, did not prohibit the building of such a vessel. No doubt our critics frankly regard such a ship as a "freak." Let us not forget that the restrictions imposed by the naval treaty are forcing fleets into a confined and artificial line of development. Under artificial conditions, artificial types of warships are bound to come. Big navies are now locked up in a kind hot-house, where strange and exotic growths—"freak" warship types—will spring up and expand. Already we have the "treaty" cruisers, which are being called, in England, the "Suicide Club," or the "Kilkenny Cat Class."

The treaty fixed the size of capital ships at 35,000 tons; this was tantamount to a new commandment, "thou shalt not build battle cruisers." A post-Jutland type of battle cruiser cannot be built below 40,000 tons, so the treaty has virtually prohibited that class of ship for the time being.* We can

*The most modern battle cruiser—H. M. S. *Hood*—was designed, before the Battle of Jutland, as a ship of 33,300 tons, and as such was not far removed from the 35,000-ton limit mark, set by the subsequent naval treaty. After Jutland, the protection was considered inadequate, and 5,000 tons of extra protection was worked into the design. The displacement then rose to 41,200 tons, or about 40,000 tons "standard" displacement. She is therefore a ship 5,000 tons in excess of the treaty maximum for capital ships. Any future battle cruiser type must be 5,000 tons smaller than the *Hood* and therefore a retrogression, either in armament, speed or protection. In the opinion of competent judges, such type, inferior to the *Hood,* is not worth building.

therefore leave the battle cruiser out of consideration for the immediate future. Further, the aircraft-carrier, despite its large displacement, is not a "ship-of-the-line." What will be the premier fighting types in future fleets, created in accordance with treaty laws? They will be the 35,000-ton battleship and the 10,000 ton cruiser, and these two types will be sundered by a gulf of 25,000 tons. Will such fleets be well balanced?

What is a "well-balanced" fleet? American officers have always deplored the fact that their Navy is *not* a well-balanced fleet. The two latest and premier fighting types of the U. S. Navy are the *West Virginia* class of battleships and the *Omaha* class of cruisers. Between these two types, the ratio of displacement in roughly 4.35 tons for the battleships to every single ton of the cruisers. That, presumably, is an example of a badly-balanced navy. The corresponding battleship cruiser ration under treaty laws is 3.5 to 1 ton. Here the want of balance is less marked than in the example from the U. S. Navy, but lack of proportion there still is. In other words, the treaty has put a premium on the evolution of badly-balanced fleets. Those powers that have bound themselves down to the treaty, and nothing but the treaty, may finally find themselves in the possession of "top-heavy" navies.

France and Italy have declined to build up their navies to so ill-proportioned a plan, involving as it does a gap of 25,000 tons between the two premier ship-types permitted. They have refused to shackle themselves to a scheme involving a huge hiatus in the ascending power of the ship-types. They have reserved their right to build capital ships of less than 35,000 tons. In other words, "they can go where the devil can't go, and that's between the oak and the rind." They can build ships "in between" the treaty battleship and treaty cruiser. Somewhere in that gap of 25,000 tons, separating the treaty battleships and cruisers, they think they can find and build the ships they want—a type too fast to be caught by the 35,000-ton battleship, and too formidable to be fought by the 10,000-ton cruiser. An "intermediate" type like this, they consider, would just about hit the big, badly-balanced "Blue Water" fleets between "wind and water." The "Jeune Ecole" may be the breeding-ground of weird ideas, but amid its fantasies has it had a flash of real insight? Has it already foreseen the day when the predominant "Blue Water" navies will have become ill-balanced, and therefore impotent to react against certain forms of attack? Are they already planning the dagger-thrust through the chink in our armor?

The *Indomptable* would be, as Commander Allen points out, less of a menace to Britain and Japan, inasmuch as these two countries now possess battle cruisers. But those battle cruisers are not immortal; some day, under the treaty laws, they must go to the scrap heap. And what will they be replaced by? The only permissible replacement-ships—new battle cruisers of 35,000 tons "standard" displacement—are not worth building, for, as we have indicated above, a post-Jutland battle cruiser requires 40,000 tons and that size cannot be now attained. We have attempted to outline a "Contre-Indomptable" type, but Captain Eggert says our "reply-ship" cannot possibly

be built. If this be so, then the last ray of hope for the "Blue Water" navies appears to be extinguished, for we get the following final position:

An *Indomptable* (a) cannot be chased and brought to action by a 35,000-ton battleship; (b) a post-Jutland battle cruiser type cannot be created within 35,000 tons; (c) a "Contre-Indomptable" type, ranging up to 35,000 tons is, according to Captain Eggert, not a practical proposition; and finally (d), the *Indomptable*, by reason of her great superiority in gun-fire, can obliterate any 10,000-ton treaty cruiser.

What, then, can be done against an *Indomptable?*

From the foregoing demonstration, the answer appears to be—

n o t h i n g !

National Policy and Naval Power

(See page 229, February, 1926, PROCEEDINGS)

CAPTAIN H. A. BALDRIDGE, U. S. Navy

Among the many excellent points brought out by William Howard Gardiner in the leading article in the February issue of the PROCEEDINGS is the one in which he emphasizes the fact that President Harding and the American delegates to the Washington Conference stated the general principle that limitation of naval armaments should apply to all types of surface vessels. It will be noted that America, if she enters the conference now proposed, and adheres to the former declared principles, should come out of the new conference greatly strengthened relatively in naval types other than capital ships and aircraft carriers, due to the fact that the 5-5-3 ratio does not now acually exist insofar as auxiliaries are concerned. America will not have any surplus auxiliary types to sacrifice, as the present ratios are already against her; and thus she has nothing to contribute as she did at the last conference. This does not mean that there will be no reduction, but only that *relatively* she will be better off if the 5-5-3 ratio is made obligatory for all types for the three leading naval powers.

President Coolidge, in transmitting to Congress his recommendations for an appropriation to cover the expenses of sending American delegates to the conference, gave a preliminary outline as follows:

It is proposed that the deliberations of the commission shall be directed to such matters as the several factors upon the powers of a country in time of war depend; whether limitation of the ultimate war strength of a country is practicable or whether disarmament should be confined to the peace strength alone; the relative advantages or disadvantages of each of the various forms which reduction or limitation of armament may take in the case of land, sea and air forces; the standard of measurement of the armament of one country against the armament of another; the possibility of ascertaining whether the armed force of a country is organized in a spirit of aggression or for purely defensive purposes; the consideration of the principle upon which a scale of armament for various countries can be drawn up and the factors which enter into the establishment of those principles, such as communication, resources, geographical situations, population, the vulnerability of frontiers, necessary delays in the transforming of peace armament into war armament; criteria, if any, by which it may be

possible to distinguish between civil and military aircraft; the military value of commercial fleets; the relation between regional security and disarmament and between regional disarmament and general disarmament.

The Washington Conference could not agree on the limitation of any types of naval warcraft other than battleships and aircraft carriers.

In this connection, it is well to recall that the American delegates, as well as those from the other four leading naval powers, mutually agreed upon accepting an "age-ton" as the unit for measuring battleship strength. The principle of the "age-ton" was, in substance, that "a battleship ton of any one of the five powers was equal to a battleship ton of any of the other four powers after the two compared tons were modified by an 'age-factor.' The "age-ton" formula was believed to be a fair one, as it was assumed, in substance, that the battleship designers of each nation for any given year, if the average were taken over a period of, say, twenty years, were equally skillful. It will be noted that this formula approximates more nearly toward an equality of such tons so far as this feature is concerned where the different nations build an equal number of battleships per year. It was assumed, for instance, that a battleship ton was not 100 per cent efficient until three years after the ship was commissioned, after which the efficiency of that particular ton decreased following a certain curve until it became zero some twenty-odd years later. It was by following this formula that the 5-5-3 ratio in battleship strength was determined.

After this "age-ton" formula had been accepted, it developed some time after the Conference had adjourned, that the American Government believed that it had the right to modernize its "tonnage" by elevating the sights of its battleship turret guns; in fact, the American Congress appropriated the money for so doing, upon the request of the president, following recommendations of Mr. Hughes, Secretary of State, who had been chairman of the Washington Conference. This modernization has not been undertaken for reasons which are not germane to this discussion.

The point that it is desired to emphasize here is that after the most careful and thorough investigation by the American delegates at the Washington Conference, and despite the agreed upon "age-ton" formula, the American Government subsequently, as shown by the actions referred to above, believed that this formula did not insure the integrity of the 5-5-3 ratio so far as our eighteen battleships were concerned.

Regarding the relatively simple problem of comparing battleship strength (to say nothing of other types of warcraft, including aircraft, bases, and strategical considerations), there are many points of view to be considered in the "age-ton" formula which space and time do not permit to be discussed here. Several of them, for example, are:

First, in a tactical sense, does any particular "age-ton" possess both a defensive power and an offensive power? If so, the formula should consider the "ton" twice; that is, the "age-ton" should be squared for each ship so considered, and the sum of the squared "age-tons" should be determined rather than the sum of the "age-tons."

Second, in a strategical sense, how should the "age-ton" be considered? Obviously, not in the same manner as in a tactical sense.

Third, in any comparison of fighting strength, if the consideration is from a tactical viewpoint it must be borne in mind that the numerical ratio only expresses the relative fighting strength at the instant the comparison is made; once an engagement actively begins (eliminating luck, skill, and morale), two factors are continuously making themselves felt: first, decrease in ability to withstand punishment and to stay afloat; second, decrease in ability to cause punishment to one's opponent. Thus, the moment battle is actively begun the comparison of fighting strength does not change arithmetically, but geometrically. The above applies particularly to ships which are approximately similar and individually have in themselves the qualities enabling each one to deliver the maximum damage to one's opponent while at the same time withstanding the maximum amount of punishment, with the maximum water tight integrity—in other words, this is the battleship.

Fourth, tactical comparisons of fighting strength cannot be made in the above manner between other types of naval craft, neither can they be made from a strategical point of view.

With the above discussion in mind, it is readily seen what a difficult thing the conferees at the coming conference are going to have if even a small portion of the "outline" quoted above is given serious consideration.

Military Communications

(See page 817, May, 1926, PROCEEDINGS)

CAPTAIN RIDLEY MCLEAN, U. S. NAVY.—Though the paper under discussion covers the essential features of naval communications quite fully, there are two features of particular importance to military communications, which I feel have not received the attention that they merit, viz: the radio compass and radio transmission of photographs.

The primary mission of the radio compass on shore is strategic; its use as an aid to navigation is purely incidental. Though its value for strategic purposes in time of war is mentioned in the essay, this function is given as "additional" to its use as an aid to navigation. Furthermore, no reference is made in the essay, to radio compasses afloat except in connection with radio beacons. The radio beacon is merely a transmitter which sends out distinctive signals. It is not in any sense "similar in its action" to the radio compass. Ships equipped with radio compasses can take bearings on the distinctive signals emitted by the radio beacon, but they could similarly observe their bearings from any other radio station whose location was known and whose transmissions could be received on the compass receiver. But again it should be reiterated, that this use of the compass, viz., for navigational purposes, is purely incidental in military communications. Were this its only use it is doubtful if radio compasses would be carried by men of war. The primary function of radio compasses afloat, the reason why

they are installed, is for use in locating the enemy in war. Other uses are entirely secondary.

The second feature is the question of transmission of photographs by radio. Though this is not yet in actual commercial operation, its state of development is such as to justify the prediction that in the next war it will be an important factor in military communication, its peculiar features being such as to eminently recommend it for these purposes.

After careful reading of this paper, I find no other detailed feature to which I feel that I can add. It would be obviously improper for me to comment in one way or another upon our detailed communication requirements in war, but it seems entirely fitting that I should emphasize the fact that the naval communication system is maintained entirely for strategic reasons.

With the recent phenomenal growth of radio broadcasting and the consequent attention which is devoted to that feature of communication throughout the land, there is a danger that the average person and even those officers whose primary interests are along other technical lines, may lose appreciation of the absolute dependence of naval operations upon efficient communication. It is for this reason that this essay on military communications is of especial value and interest at the present time. In times of peace, when economy of federal expenditures is the watchword, when war is, according to the ideas of the individual, either obsolete or at least a catastrophe of the indefinite future, the civilian population represented by the press and by Congress is prone to regard a naval communication system either as a convenience or as a possible source of governmental economy. This being the case, it is only human, if these prevalent ideas in the civil community sow seeds which, as peace continues, sprout in the subconscious minds of officers themselves.

Therefore, I feel that the most effective contribution which I can make to this discussion is the statement that though in the naval communication service we practice and preach economy in every way, though as a matter of economy we gladly handle traffic for all government departments, the reason for maintaining the naval communication system in peace is neither its convenience nor its economy. The naval communication system is maintained for exactly the same reason as is the fleet iself. It is a part of the fleet, it provides the means to insure the effective operation of the fleet when its services are required. If fleet communications were correctly represented by the ideas of some, namely, the ability of the Department to transmit despatches to the commander-in-chief, there would be no necessity for so extensive a system. The facts are, however, that the problem of naval communications involves the most complex radio traffic problem which has yet developed. The necessity for the simultaneous operation of eighty or more radio circuits in the small area occupied by an assembled fleet, involving communication between ships in close proximity between unit commanders, between ships and planes, ships and submarines, ships and shore stations, presents a problem capable of solution only by systematic

planning, specially designed apparatus, continuous development, and consistent training—and of these the questions of systematic development and continuous training in peace are probably the most important.

It is for this reason that the development and building up of the communication system in peace is a military problem of major importance. Failure to appreciate this would be in all respects tantamount to failure to appreciate the necessity for holding target practice in peace. The economy and convenience derived from the system in time of peace are purely by-products.

Though plans must be made for the efficient use of commercial systems which will be taken over in war, it is apparent that as these systems are not available for our use in peace, and cannot become a part of the fabric of the organization which we must develop in time of peace, they must supplement rather than replace our naval system when war is declared.

EDITOR'S NOTE: Captain McLean is Director of Naval Communications.

LAUNCH OF H. M. ARMORED CRUISER "SUFFOLK"

The Engineer, 19 Feb.

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PREPARED BY

LIEUTENANT COMMANDER H. W. UNDERWOOD, U. S. NAVY

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LAUNCH OF H. M. ARMORED CRUISER "SUFFOLK"

The Engineer, 19 Feb.

GREAT BRITAIN

Speculating on Geneva

The Naval and Military Record, 24 February, 1926.—A statement is going the round of the United States press that when the Geneva Conference on the limitation of armaments gets to work Great Britain will propose the abolition of the battleship and the submarine, but America will oppose both suggestions. Probably, like a good many other paragraphs concerning the British Navy which appears in the United States press, this is purely speculative, and in our view the only feature of it which is of definite interest is the alleged attitude of America towards any such proposal, a point upon which American newspapers may have some authentic knowledge. The idea that this country will put forward the abolition of the submarine for international consideration may be dismissed forthwith. That we should be only too willing to acquiesce in the abolition of the submarine is beyond question, and this is one of the principal reasons why other naval powers, which realize that we have less to lose and more to gain than any other nation by such a step, have quite made up their minds not to assent to it.

On the other hand, it is not improbable that Great Britain may suggest restricting the size of submarine forces to the narrowest limits to which it may be possible to secure agreement. But here, again, the prospect of success does not appear very bright. France is very demonstrative as to her dependence on the *Sousmarin* as her chief weapon of naval defence. Italy must needs respond to such a policy on the part of her great Mediterranean neighbor. Japan says no more on the subject than she can help, but she steadily continues to build submarines, and the great potential value to her of the "mandate" islands as submarine bases in the event of war is undoubtedly the primary factor of influence in her plans. The United States regards the submarine as an important contribution to the defences of her very extensive seaboards, and this, again, is a sound tactical view. It is therefore pretty clear that any anti-submarine proposals on the part of Great Britain would be very much in the nature of a voice in the wilderness. Knowing this, we do not think it very likely that the voice will be raised.

The problem of the battleship, however, is quite another story, and in this case we are prepared to believe that the American newspaper statement is merely an example of intelligent anticipation. France, Italy, Russia, and Germany still retain a certain number of warships built as battleships, but they are all of such relatively low standard of fighting value in the present-day scale as not to call for serious consideration in this category. As far as it is possible to judge, none of these countries contemplates building any more capital ships. France is free to lay down a 35,000-ton ship whenever she chooses, Russia is under no treaty obligations at all. It seems reasonably to assume that any proposal to abolish the capital ship would meet with no opposition on the part of these powers. By "abolition" we must not contemplate the immediate scrapping of existing fleets of battleships, but a process of climination by wastage, with a possible time limit within which total withdrawal must be effected.

The attitude of Japan towards this question is naturally of first-rate importance, and here we are to a large extent "left guessing." But taking the strategical situation of Japan, and visualizing the probable character of any sea war in which she may conceivably be engaged, she could very well do without the battleship if her potential rivals agreed to do the same. Strategical students are pretty well agreed that Japan's policy, in the event of war, would be to await attack in contiguous waters, so as to be able to utilize the full measure of her strength within easy reach of her own bases, to the corresponding disadvantage of a long-distance enemy. How far such an enemy would acquiesce in such a plan is quite another matter; Japan is

in the position of being able to follow this principle from the fact that she has no other territories to defend but her own empire. Probably her offensive operations would be limited to attacking the bases of her enemy, an operation in which battleships admittedly might be used to advantage. But the main purpose of such an attack would be to land a military expedition, and as the chief danger to the transports would come from submarines and destroyers, and mines, and as the value of the battleships would lie chiefly in dealing with the heavy shore batteries—at obviously great risk to themselves—they certainly cannot be regarded as indispensable to such an attack.

That the United States should oppose the proposal to abandon the capital ship, as the American newspaper statement alleges, is certainly difficult to understand. Of all the great maritime powers, she has the least use for the battleship. The grand manœuvres carried out last summer by the Pacific fleet were based upon the presumption that Honolulu might succumb to the attack of a great armanda—as, of course, it did in the view of the umpires. In this case the Pacific fleet was really playing the rôle of an enemy force. But let us assume that, in the event of war with a big Pacific power, the United States fleet took up its war station at Honolulu, what are its battle squadrons going to do? Wait for the enemy, whose whole strategical policy is to do precisely the same thing?

Whenever the United States goes to war—to naval war—it is bound to be with a remote enemy. More than any other type of modern warship the battleship is a "base limpet." She is too valuable to risk except for big things, and the experience of the Great War was that the weaker side is not going to give any opportunity of big things save on terms of prohibitive risk. So long as Japan maintains battleships, we admit that the United States has no choice in the matter. But it is surely rather paradoxical that, in the event of Japan concurring in the alleged intended proposal of the British Government to do away with the "premier unit," the United States should oppose it. In a general way it is true to say that the battleship is only wanted to fight the battleship. However else she may be employed, actively or passively, this is her *raison d'etre*. Now suppose for a moment there were no other battleships left to fight, would the United States still want to maintain the capital ship? This appears to be the question she will have to ask herself at the coming Geneva Conference. If she answers it in the affirmative, then Great Britain and Japan will have to go on maintaining capital ships too, and President Coolidge's earnest desire to see armaments still further restricted will not amount to very much.

The Navy Estimates

The Engineer, 5 March, 1926.—The Navy Estimates for 1926-27, as foreshadowed in a statement by the First Lord of the Admiralty, contemplate a net outlay of £58,100,000, which is £2,400,100 below the Estimates for the financial year now drawing to a close. By a rigorous pruning of expenditure in the administrative branches of the service and in the maintenance charges of shore and floating establishments, the Admiralty has been able to effect a saving of more than £5,000,000; but since half this sum is set aside for the new construction to be put in hand during the coming year, the actual amount saved is approximately two and a half million. It will be seen therefore that the Admiralty has carried out the pledge it gave last summer, when, in return for parliamentary approval of the five-year shipbuilding program, it undertook to curtail the general cost of the navy by every means possible. Drastic measures were necessary to fulfil that pledge. The fleets in the Mediterranean and home waters have been reduced. By the end of this month the Mediterranean command will include only six

battleships, instead of the eight of which it has hitherto consisted Four ships of the *Iron Duke* class are coming home to form a training squadron for boys. Nominally they will be part of the Atlantic fleet, but in view of the duty to which they have been assigned their presence will add little to the war-readiness of that fleet. Their place in the Mediterranean is to be taken by two ships of the *Royal Sovereign* class. Admiral Sir Roger Keyes will thus have six battleships armed with 15-inch guns, but having regard to the 4 knots disparity in speed between the *Queen Elizabeths* and the *Royal Sovereigns,* his fleet is not so homogeneous as could be wished. Four well-known battleships are to be discarded in the near future under the terms of the Washington Treaty. The *King George V., Centurion* and *Thunderer* will be disposed of to shipbreakers, but the *Ajax* is to be retained as a fleet target ship in place of the *Agamemnon.* The removal of these vessels from the active list is rendered necessary by the approaching completion of the *Nelson* and *Rodney.* Further economies are made possible by the scrapping of three cruisers, thirty-four destroyers, and five depôt ships, and by the closing of Rosyth and Pembroke dockyards.

That establishments and ships which have clearly outlived their utility should be written off is all to the good, but while there can be no rational objection to the closing of redundant dockyards, naval opinion is opposed to the ruthless condemnation of ships which are still good for years of effective service. We understand that many of the destroyers now on the condemned list are still sound in machinery and structure, and could be made thoroughly serviceable by the re-tubing of their boilers. It is to be regretted that, in the absence of funds for this work, so many useful craft should be lost to the navy. Provision is made in the Estimates for the following new construction:—Two "A" class cruisers of the *County* series, displacing 10,000 tons; one "B" class cruiser of 8000 tons; six *O* class submarines, probably similar to the *O-1,* of 1345 tons, now in hand at Chatham, one submarine depôt ship; one repair ship; and four motor launches. These vessels form the second year's instalment of the quinquennial building program introduced last July, which provides for a total of eighty-one units, plus a floating dock, at an estimated cost of £58,000,000. According to official figures, the two "A" class cruisers to be laid down in 1926 will cost together £4,000,000; the "B" cruiser is likely to cost £1,750,000; the six submarines, priced at £400,000 each, will absorb £2,400,000, while the two auxiliary vessels and the four motor launches can hardly be built for less than £450,000. At a conservative estimate, therefore the building and completion of the vessels provided for in the new naval budget will represent a total charge of £8,600,000, or about £3,500,000 more than the sum which administrative and other economies are expected to save during 1926-27. These figures make it plain that the savings which the Admiralty hopes to achieve in other departments of the service are not sufficient to balance the cost of new construction, and since a halt must soon be called to the deletion of ships and the reduction of the commissioned fleet—the two measures which appear to be mainly responsible for the saving of £5,000,000—it is to be feared that the Navy Estimates for 1927-28 and succeeding years will be considerably higher than those now submitted. From 1926-27 to 1929-30 inclusive, an aggregate sum of £46,000,000 is to be spent on new construction, while an additional sum of £12,000,000 will be required to complete all the vessels laid down during this period. Unless the financial significance of our new, and very necessary, shipbuilding program is clearly understood beforehand, the Admiralty must be prepared to encounter a great deal of uninformed criticism on the score of its "profligate expenditure" and "broken pledges." The essential facts to be borne in mind are that from the present year to 1932 we shall be spending an average of £8,000,000 a year on new construction, and that there is little prospect of this annual charge being defrayed by corresponding retrenchment in other

navy votes. Of ships built under the war program, the cruisers *Effingham*, *Emerald*, and *Enterprise*, the flotilla leader *Keppel*, and the submarine *L-27*, will have passed into commission by the end of this month. The cost of these vessels has been greatly increased by their slow rate of construction. The submarine cruiser *X-1* is also due to be commissioned before March 31. As she was laid down on November 2, 1921, she has taken fifty-three months to complete, but the delay is understood to have been caused by the exhaustive nature of the trials which were considered necessary in view of the experimental nature of the design. By the time she joins the fleet this huge submarine will have cost the country £950,000. Of ships distinct from the five-year program, there remain to be completed the cruiser-minelayer *Adventure*, the destroyers *Amazon* and *Ambuscade*, and submarines *L-26* and *O-1*. As no date for the completion of the *Nelson* and *Rodney* is given in the First Lord's statement, these battleships will apparently not be ready for service until the financial year 1927-28. Pending the publication of the Estimates, no information is available as to the progress of work on the new fleet base at Singapore. The original intention was to recondition one of the ex-German floating docks for use at Singapore, but this having been found impracticable a new dock is to be ordered. A considerable amount of ship reconstruction has been undertaken during the past year. The *Warspite* will soon emerge from dockyard hands fitted with bulges, and her sister ship *Valiant* is to be similarly equipped. The battle-cruiser *Renown*, which has been re-armored and otherwise renovated, is to be completed this year. Further progress is to be made with the reconstruction of the *Courageous* and *Glorious* as aircraft carriers. By the Admiralty's decision to scrap the least efficient of the cruisers and destroyers, the original program of re-tubing work on these vessels has been substantially diminished. Provision is made for continuing the modernisation of electric generating stations in the Royal dockyards and shore establishments, for the equipment of a steel foundry at Portsmouth, and for supplying machinery of the latest pattern to the dockyards.

Naval aviation and general fleet training form the subject of interesting notes in the First Lord's statement. There are now seventy naval and marine officers employed as pilots, and forty-two are still under training. In future, all executive officers are to undergo a short course in elementary naval aeronautics in an aircraft carrier, either as midshipmen or junior commissioned officers. It is hoped in this way to increase the interest taken by young officers in the work of the navy's air service. "All R.A.F. aircraft hands for general duties in the Fleet Air Arm have been replaced by R.N. ratings. These substitutions have resulted in economies in that they have enabled the total complement of aircraft carriers to be substantially reduced, since the naval ratings are available for and capable of undertaking ship duties which the replaced airmen were not trained to perform. . . . . Steady progress in the use of aircraft by the fleet is indicated in reports received from sea." Throughout the year gunnery and torpedo practices have been conducted on advanced principles, the object being to evolve methods of meeting every tactical situation. A marked improvement in fire discipline is noted. Anti-aircraft gunnery continues to receive special attention, and good results are anticipated when the new material now on order is supplied. Satisfactory progress is reported in the development of measures against submarines. The *personnel* of the fleet is to remain at the same total as last year, viz., 102,675, from which number—thanks to the withdrawal of older ships—it will be possible to provide crews for all new construction up to and including the 1925 program. As a minor measure of economy, the special reserve of engineer officers is to be discontinued on its present basis, but the reserve will be retained on a non-training basis. No reference is made by the First Lord to the Admiralty's singular treatment of engineer officers of the navy, who for reasons still unexplained have

been summarily deprived of their combatant status. We know, however, that the last has not been heard of this arbitrary and uncalled-for treatment of a devoted body of naval officers, and that the great institutions which have taken the matter up are continuing their efforts to get engineer officers fully reinstated.

The Air Estimates

Engineering, 5 March, 1926.—The task of His Majesty's Ministers in balancing what are regarded as the essential requirements of the services against the existing need for economy in expenditure, is certainly an onerous one, and the difficulties are particularly acute in the case of the Air Service, the eventual developments of which can hardly be foreseen. It is, however, mainly for the immediate future that Ministers have to provide. In the next financial year, the Air Ministry proposes to spend £16,000,000 in maintaining the air policy approved by successive governments in recent years, the sum mentioned exceeding that for the current financial year by £486,900 and the difference being accounted for by expenditure in connection with the additional squadrons recently formed.

The defense of this country against a possible attack from the air is, of course, the foremost consideration of British air policy, and for this purpose it is proposed eventually to provide a force of fifty-two squadrons, of which twenty-five have already been formed, while three more will be added during the coming year. In consequence of the improved aspect of international politics created by the signing of the Locarno Treaty, the opinion of the government, as expressed by Sir Samuel Hoare, the Secretary of State for Air, in introducing the Estimates in the House, on Thursday of last week, is that the formation of the complete defence force may safely be extended over a longer period than was originally intended. It is realized, however, that the delay may have an adverse effect upon the British aircraft industry, which is, of course, mainly dependent upon Air Ministry orders for its existence. Actually it appears that £5,351,000 are to be spent on aircraft, airplane engines and spares in the year ending March 31, 1927, as compared with £5,864,000 in the current year, the reduction thus amounting to £513,000. It is intended, however, to spread the orders so as to keep as many key men as possible employed in the various aircraft-manufacturing firms, this being obviously of the utmost importance in case it should become necessary to expedite construction in the future.

Another announcement of considerable interest and importance to the aircraft industry was made in Sir Samuel Hoare's speech. As is well known, the industry has experienced considerable difficulty in obtaining orders for machines from foreign clients, one reason for this being that the restrictions hitherto placed by the Air Ministry upon the sale of new models, have rendered it almost impossible for manufacturers to offer other than more or less obsolescent machines and engines. These restrictions, Sir Samuel stated, were necessary for some years after the war, but he added that it had now been decided to relax them considerably. It will thus be possible, in future, to place new types of machines and engines on the foreign markets much earlier than has previously been the case. This, we feel confident, will eventually prove of material advantage to the aircraft industry, as well as to the country as a whole, by increasing the proportion of export to import trade.

The upkeep of the experimental and research establishments will cost £95,000 in the coming year, and a sum of £241,000 has been allowed for miscellaneous research work. It will be remembered that the research department has been reorganized under a newly-created Director of Scientific Research, and the new organization, it is understood, is working well. The main problems under investigation are stability and control, metal construc-

tion, and supercharging of airplane engines, although some additional problems have resulted from the invention of the auto-giro flying machine invented by Senôr de la Cierva. Machines of this type are now being constructed in this country in order to investigate more fully the possibilities of the invention for civil and military purposes.

A sum of £332,000 is allocated in the Estimates for airship development, as compared with £440,000 in the current year. The government's airship policy, which is now entering on its third year, comprises the construction of an airship of 5,000,000 cub. ft. capacity at Cardington, and another, of the same capacity, by a private firm. The program, however, has been retarded by the breakaway of the *R.33* from her mooring mast at Pulham in the spring of last year, the accident having prevented necessary experimental flights from being carried out until late in the year. The flights then made—in the course of which, it will be remembered, an airplane was successfully released from and re-attached to the airship in flight—were satisfactory. It is not now intended to carry out the flight to Egypt by one of the existing airships, originally planned for the current year, since the experience to be obtained from it is not essential.

The net vote for civil aviation amounts to £462,000, of which the main items are £216,500 for works, buildings and lands, and £180,000 for subsidies. The expenditure covers the maintenance of the airdromes at Croydon and Lympne, ancillary services on the regular air routes, operational experiments, and the supply of technical equipment. It is to be noted that the subsidy agreement with Imperial Airways, Limited, has been slightly modified, the annual minimum mileage requirement of 1,000,000 having been changed to a minimum of 425,000,000 h.p. miles—presumably to allow for and encourage the employment of machines of higher engine power. An additional agreement has been entered into with the above-mentioned company for the establishment of a regular fortnightly service, operated by three-engined machines, between Egypt and Basrah, via Baghdad, and between Bashrah and Karachi, the object being eventually to establish a regular weekly service between Egypt and India. The item of £216,500 for works, buildings, and lands, includes a sum of £134,500 to be spent on the enlargement and improvement of Croydon airdrome, work which is much needed and has been long delayed.

The meteorological services of the Air Ministry are of value not only to the Air Force and civil aviation, but to the community in general and to farmers and mariners in particular. Their utility, as is well known, has been greatly increased by the development of wireless telephony. In addition to the general forecasts regularly broadcast from all stations of the British Broadcasting Company, arrangements have recently been made for the broadcasting twice daily from the high-power station of that company at Daventry, of forecasts specially prepared in accordance with the requirements of agriculturalists and navigators. Moreover, the forecasting service has been reorganized, so that it is now possible for aviators in any part of the country to obtain, within a few minutes, a reliable report on the existing weather conditions along any air route and a forecast of the changes likely to occur in the course of a journey. The cost of the services remains practically unchanged, the total allowance for the ensuing year being just under £126,000, which can hardly be regarded as excessive in view of the general utility of the work. In addition to the recording and forecasting of weather conditions, a considerable amount of valuable work on the purely scientific side of meteorology is carried out by the department, especially at the Kew and Eskdalemuir observatories, although the allowance for this class of research, apparently, does not exceed £2,000. The subjects at present under investigation include atmospheric electricity, terrestrial magnetism, and seismology, in all of which there is certainly need for increasing existing knowledge.

The New Cruisers

The Engineer, 19 February, 1926.—With the launch of H.M.S. *Suffolk* at Portsmouth on Tuesday the process of rebuilding our cruiser fleet on modern principles may be said to have begun. Four sister ships are soon to follow her down the ways, while the two Australian vessels which are under construction on the Clyde should be ready to go afloat before the end of the year. In view of the official practice of treating details of new construction as confidential until the vessels themselves pass into service, it is not possible to compare our new *County* cruisers with the newest foreign designs, which, by the way, have been widely published. We know, however, that the *Suffolk* and her sisters conform to the requirements of the Washington Treaty, in that their displacement is restricted to 10,000 tons at light load, and the caliber of their guns to 8 inch. But no artificial limit has been set to their speed, and it is freely stated that in this attribute they will excel the swiftest cruisers now building abroad, some of which have a legend velocity of 34 knots. To achieve even this speed with a vessel of 10,000 tons, burdened with a heavy armament of 8-inch guns, it would be necessary to dispense entirely with armor protection, and we do not think that British naval opinion would approve such a sacrifice. Though a combination of gun power and speed may still represent the tactical ideal, war experience has bred a new respect for defensive qualities. Admiralty views on this question were reflected in the remarks made by Captain (now Rear Admiral) Sir Alfred Chatfield when discussing the design of H.M.S. *Hood* at a meeting of the Institution of Naval Architects in 1920. Referring to the emphasis which had been laid on speed as the chief desideratum in naval warfare, he said that those who had fought at sea held a different opinion. The claim that speed enabled a commander to choose his range and also to decide whether to engage the enemy or not, had not been upheld by actual experience. Assuming it to be the duty of a British ship always to engage the enemy, speed was not wanted for running away. As for choosing the range, "those who have been in action know perfectly well that in ninety cases out of a hundred the factor which determines the range at which you will fight is the Clerk of the Weather. If you cannot see more than 10,000 yards it is no good having speed which would enable you to keep 25,000 yards off. You have got to come in to the distance at which you can see the enemy, and when you come into that range then the man who has got plenty of speed but no protection finds himself in a very awkward position. That is what has happened time and again." Coming from an officer who commanded fast ships throughout the war, these remarks on the relative value of speed merit the most careful consideration. It is true that Admiral Chatfield was speaking of capital ships, but his general thesis is just as applicable to cruisers. We are, therefore, reasonably confident that in the design of our latest cruisers a balance has been struck between the rival claims of speed and endurance to punishment.

At the same time it will clearly be impossible to endow these ships with the measure of protection they might have received but for the Treaty restriction on displacement. If they are ever called upon to fight their adversaries are likely to be ships mounting the 8-inch gun. To resist the projectiles of this weapon, except at very long range, 6-inch armor at least is required, even allowing for the chances of oblique impact. Yet the weight involved by a partial belt of this thickness would be prohibitive in a 10,000-ton ship of great speed and heavy armament. In the *Hawkins*, which bears a general resemblance to the *Suffolk*, the maximum thickness of the vertical plating is 3-inch, with 1½-inch armor on the decks. It will be surprising if the *Suffolk* shows any improvement on this system of protection. Cruisers of the *Treaty* type will therefore be exceptionally vulnerable to gunfire, and perhaps not less to under-water attack. They will have the

power of delivering heavy blows with small capacity for resisting them. But for the fact that this peculiarity will be common to all cruisers, whether British or foreign, built under the rules of the treaty, it would afford grounds for trenchant criticism of the new ships. As it is, we own to a feeling of regret that circumstances should compel us to build vessels of which the design, however unavoidably, does violence to a cardinal principle of man-of-war construction. There is, however, no alternative. We could not remain passive while other powers were turning out cruisers superior in speed and gun power to our best ships. A glance at tables of foreign construction is sufficient to show that we have deferred our program of replacement to the very last moment. Since the war forty-seven cruisers have been laid down by the various maritime states, and of this total only seven are British. At the present time there are twenty-nine cruisers in service with speeds of 33 knots or more. Of these, only two are British. This is not a position which can be allowed to continue, having regard to our immense volume of floating trade and our dependence on overseas supplies. No time is to be lost in laying the keel plate of a new *County* cruiser on the Portsmouth slip vacated by the *Suffolk*, another is to be laid down at Devonport, and orders for two others have just been placed, one with William Beardmore and Co., Limited, and the other with R. and W. Hawthorn, Leslie and Co. Limited. In the coming financial year three more cruisers are to be laid down, but of this trio only one will be of the *County* or "A" class. The others are to be of a smaller type, designated the "B" class, and displacing about 8000 tons. In each succeeding year, from 1927-28 to 1929-30 inclusive, one "A" and two "B" ships are to be built. Consequently, if this program is adhered to, we shall eventually have sixteen new cruisers of 10,000 tons, mounting 8-inch guns, and seven of 8000 tons, probably carrying lighter metal. In actual sea speed—as distinct from the often illusory trial speeds attained under artificial conditions—and in sea-keeping qualities, these twenty-three ships will, no doubt, be equal to the best foreign cruisers of coeval design. This total, it should be observed, includes the *Australia* and the *Canberra*, which are being built for the Royal Australian Navy. We shall possess, in addition, the four Improved *Birminghams*, of 9750 tons and 30-31 knots' speed, armed with 7.5-inch guns; the *Emerald* and the *Enterprise*, of 7600 tons and 33 knots; and the *Adventure*, a cruiser-minelayer of 7260 tons, the speed of which is not yet known. This will give us a grand total of thirty ocean-going cruisers. The number is certainly not excessive, and is, in fact, twenty-two less than the establishment which the Admiralty, only two years since, declared to be the minimum consistent with future requirements. It is to be hoped, however, that measures will be taken at the proper time for continuing the systematic replacement of obsolete material, a policy that is more economical than the practice of suspending construction for a term of years and then making a frantic effort to overtake arrears.

While there is, as we have seen, a shortage of oceanic cruisers, we are fairly well provided with vessels adapted for duty with the fleet, either as scouts, screening ships, or flotilla flagships. We have thirty-one "D" and "C" class cruisers, at least half of which are fully effective, and should remain so for a long time to come. At some future date the whole question of cruiser policy will have to be reviewed. Ships of 10,000 tons, costing £2,000,000 each, may be essential for commerce protection, but for fleet service they are needlessly large. Even the projected "B" ships are 2500 tons heavier than the largest unarmored cruisers that were attached to the grand fleet during the war. It should be possible to design a fleet cruiser with a speed of 33 knots and an adequate 6-inch armament without going beyond 6000 tons. Japan in late years has built many vessels approximately of this type, which appear to be giving satisfactory results. The problem may be simplified by new advances in the science of ship construction and

engineering. Sir E. T. d'Eyncourt has publicly referred to the existence of Colville's controlled elastic limit steel, which combines lightness with extraordinary strength, and which, if employed for shipbuilding, would enable hull weights to be cut down very considerably. Further economies in weight may be effected by the adoption of boilers and turbines for higher pressures, a development soon to be put to practical test in the experimental steamer now being built on the Clyde. Admiralty constructors are doubtless keeping fully abreast of technical progress, and particulars of their latest cruiser design will be awaited with interest by the engineering community.

Lower Fleet Resources

The Army, Navy, and Air Force Gazette, 13 March, 1926.—The full figures of the Navy Estimate, published last week-end, show that the First Lord is entitled to the thanks of the taxpayer for the net economy of well over two millions which has been secured in spite of the growing cost of shipbuilding program and other rising commitments. Naturally, this result is not attained without sacrifice, and whether the pruning knife has not gone too far time alone will show. It is significant that the four votes in which the cuts are proportionately heaviest are those very vital to the efficiency of the fleet—the Air Arm, reduced by nearly 50 per cent, dockyard material and naval armaments, reduced by about 20 per cent each, and naval reserves, in which a cut of 10 per cent is made. Compared to these, the reduction—more apparent than real—of a meager 2 per cent in the Admiralty Office vote is ridiculous.

In some ways, the most surprising item in the whole of the Estimates is that for fuel for the fleet. The importance of this cannot be gainsaid. It is admitted by everyone that the whole power of the navy rests upon the fuel which gives it mobility. Last year the estimated fuel bill was £3,743,400. In the economies made in July, to balance the first cost of the new shipbuilding program, it was reduced by £120,000. It is now reduced again by the enormous sum of £1,291,200. Some of this is due to lower prices of oil fuel and coal. But the great bulk is manifestly due to the decreased requirements which are expected from the fleet in the next twelve months. The estimated value of the issues of fuel to be made to ships is £2,437,200, quite the lowest in recent memory. A year ago it was £3,141,400; two years ago it was £3,018,650; and even in 1914, when the issue was largely coal, and prices were much lower, it was £2,633,800. No wonder the First Lord says that no reserve fleet exercises are possible again this year.

Imperial Defense and the Coordination of the Three Services

By Major-General Sir J. H. Davidson, K.C.M.G., C.B., D.S.O., M.P., *The Journal of the Royal United Service Institution*, February, 1926.—I hope you will forgive me if I preface my remarks this afternoon by making a few personal observations. I have been asked to speak on the subject of Imperial Defense and the Coordination of the Three Services. I am not sure that you understand what I mean by this. What I understand by it is the consideration of the higher organization of the services and of governmental machinery for ensuring economy and efficiency, avoiding overlapping, duplication and waste, securing coordination of effort in all matters of administration and defense which relate jointly to two or more of the services. I think it is as well to define exactly what the meaning of this subject heading is before we start.

I hope I may count on your indulgence this afternoon in my endeavor to deal with a subject which I think all will agree is as controversial, complex and, nevertheless, important as any subject could well be. I ask your

indulgence especially today, seeing that an officer well known in America and of high rank in the American service has recently been arrested for propagating his opinion on this very subject.

You may well ask who am I to express opinions on such weighty matters. My answer is that I claim no qualifications for dealing with it except that I am interested in the subject; I did not volunteer to deliver this lecture, but merely took my orders from a chief whose authority I have never questioned.

The only virtue I can claim apart from a general interest in the subject is this: That the politicians possess a monopoly of the brains of the country--at least we have this assertion from the leading politicians themselves, and therefore I think no one can controvert it—and you will remember that I am a politician. On the other hand, my own belief is that the soldiers, sailors, and airmen have as good as, if not better, brains than anybody else, and in this connection I take the opportunity of classifying myself as a soldier.

On your part I am naturally assuming that everyone present here this afternoon has read the speeches of various prime ministers, chancellors of the exchequer and cabinet ministers on the subject, has read all the articles in the newspapers and periodicals and all the reports of the various conferences and committees which have been held, such, for example, as the Geddes, Weir, and Salisbury Committees and others.

For my own part I see very little achievement in all this mass of speech-making and literature, but a great diversity of opinion. Nor do I get much enlightenment from those papers which have been composed by soldiers, sailors or airmen, for in some they ignore the political aspect of the problem, and in nearly all they neglect the financial aspect altogether.

In any case the upshot of all this discussion and writing is nothing. The Committee of Imperial Defense remains the same, except that it is given substance now instead of shadow, and except that the three chiefs of the staff are supposed to have joint responsibility of an indeterminate character entirely imaginary and without any reality whatsoever.

Is There any Necessity for a Change in Our Defense Organization?

The question I have to put to you is this: Is there really any necessity for change in our organization and machinery for defense and in our system of control and coordination? Is there any reason for the complaints which we are constantly hearing on all sides, or ought we to be satisfied with the existing state of affairs as the best which can be devised and sufficient to meet all requirements?

I remember before the war reading the history of this country, especially the military history after the Napoleonic Campaigns, and since the war I have read one or two interesting articles on that particular topic. It has always seemed to me, and it seems to me today, that both the navy and the army were in a very high state of efficiency at the close of the Napoleonic Wars, but that in a very short space of time—I think very largely owing to the requirements of economy—those services did lapse into a state of inefficiency, a degree of inefficiency, at all events. Peace is not conducive to efficiency, and unless one keeps one's eyes open and one's organization up to a pitch of excellence the demands of economy, especially after a great war, may have the result that the services will lapse into a state of inefficiency. Today those factors are present just as much as they were a hundred years ago.

Today we have, as everyone here knows, an insistent demand for further economies. We have the advent of the Air Arm and many technical difficulties which did not exist a hundred years ago, an empire more difficult to defend today than one hundred years ago, and, moreover, any great war

today means the mobilization of the whole nation and the whole national resources. Who would say that our organization, which is virtually the same as in pre-war days, is the best that can be devised, or is adequate? The point is: Is the organization and machinery which was in existence before the war sufficient to cope with our task as it presents itself to us today?

The Status of the Air Ministry

One complex matter, which makes it very difficult to deal with this question, is the introduction of a third Ministry, the Air Ministry, and I think before I go any further in my remarks I should deal with this problem and come to some conclusion upon it. There is undoubtedly a very strong feeling against the existence of the Air Ministry at all, and there are many officers in the navy and the army, and civilians also, who believe that the Air Ministry *qua* Ministry should be abolished, and that in its place some central department for research and supply should be instituted and that the aircraft of this country should be divided between the navy and the army.

I have had many interesting discussions with officers of the army in positions of authority, who have expressed the opinion to me that the War Office should swallow the Air Ministry and merely disgorge a wing to the navy, and I have had certain discussions with naval officers, and I have read papers written by naval officers who suggested that the Admiralty should swallow the Air Ministry and merely disgorge a wing for the army. I am not going to waste time in dealing with this subject at great length, because I do not think it is worth the time and trouble, for I do not believe that any party or any government would take the responsibility of abolishing the Air Ministry, primarily on account of three stock arguments, which are always produced in any discussion on the subject:

1) The people of this country are nervous of air attack, and it has been agreed by the Committee of Imperial Defense that the risk of air attack has increased, while that of seaborne invasion has decreased. This has undoubtedly created an impression on the public mind. Both the public and the press are jealous of any interference with the Air Ministry.
2) If the air is divided as an auxiliary to the two older services, air development will be arrested to some degree.
3) It was the practical experience of war which gave birth to the Air Ministry, and if it had not been for the war it would probably have remained divided between the other two services.

I do not attach so much importance to the last argument as I do to the first two, but nevertheless those three arguments, as I know from addressing public meetings and talking to many people, have undoubtedly made a deep impression on the public mind, an impression which will not be easily dissipated.

We do not get much guidance from foreign countries. Our task is so different from that of other nations. No other nation is at the same time both subject to serious air attack from a neighboring country, dependent for its supplies from overseas, and responsible for possessions in every quarter of the globe.

America is often quoted as a country without an Air Ministry, but she is not subject to air attack of any magnitude whatever. Her case and ours are utterly dissimilar. France also is quite different, for her defense is concentrated in her army; she has a constant well-defined defense problem before her. Italy, on the other hand, has her three ministries, and she has her machinery for coordination, in her Supreme Commission of Defense, and Supreme Chief of the General Staff.

I look upon the development of aircraft in the future as of immense importance. I believe everyone is agreed on that. I regard the air weapon as a great moral weapon which, if used properly and in sufficient numbers will be capable of lowering, if not destroying, the national will power of an adversary. It will be effective against cities, centers of production and communications, and provide the best means of defense against air attack. The argument as to whether aircraft are or are not effective against ships or troops in action has nothing to do with the point I wish to make, namely, the great moral power of the air in future wars.

In my opinion the Air Ministry has come to stay, and it is our duty not to quarrel with it, but to make the best of it and accept it, and see how best we can adjust our defense organization so as to include it. I do not mean by this that it is not necessary for the navy and army to have their own Fleet Air Arm, and Army Cooperation Squadrons, or whatever you may call them—this is essential for artillery observation and reconnaissance purposes. I go further and believe that, for example, the man who observes for artillery from the air should be above all an artillery man.

It seems to me that a natural corollary to my argument is that if you have only two services you may possibly leave the coordination to them—but if you have three services you must devise some machinery for coordination. If you had ample funds and economy was of no great importance, the necessity for coordination would not be so pressing—but in proportion as the requirements of economy are urgent, so in the same ratio is coordination urgent.

This brings me to my next point—the matter of economy.

This is a vital matter. As I have already indicated, it would be a comparatively simple matter, even without any effort in cooperation, to supply the full requirements of imperial defense if there were ample funds available, but that is precisely where the difficulty arises—a difficulty which is seldom recognized in the services.

We are spending today over 120 millions a year on defense, and yet each service is being cut down to the bare bone. We live under a democratic form of government, with a very wide franchise and a mass of uneducated voters. The House of Commons controls the national purse strings and its members are elected in the main by those who clamor for larger expenditure on social services and for greater support of the League of Nations and reductions in armaments. From a body such as this you cannot expect, nor will you get, an increase over the 120 millions, but you can expect and will get a considerable reduction in the years in front of you.

The average voter in an industrial area will vote for the man who advocates a better education for his child and a higher old age pension for himself. He does not really care about the services however much you may talk to him. If you do not believe this I would just like to draw your attention to the fact that at the last general election there was a great wave toward Conservatism, but notwithstanding that wave, which is exceptional, and not the rule, the Labor party had something like one million more votes polled for them than they had at the previous election. I want to put that aspect to you and another aspect. There is the other kind of person who says—with truth—that the present rate of taxation is a burden on industry, and if he cannot get economy in other directions he will press for it in the direction of armaments.

There is yet another aspect of finance, and an important one. You in each service, base your organization on expansion for war. The same thing is necessary in finance. There is not much capacity for expansion with an income tax at the rate of 4 shilling in the pound, and a deadweight of debt of something over 7,000 million sterling. Yet, in a great war, we should have to raise money somehow and our financial expansion would be just

as important as, if not more important than, our military naval and air expansion.

If the services think they can maintain their combined expenditure at the 120 millions level, or anything near it, I am afraid they are much mistaken.

It comes then to this: we shall have to discard ideals and get down to bare essentials and go in for a process of substitution. By that I mean that we shall have to do the sort of thing that the Admiralty recently did, namely, cut down dockyard expenses in order to build more cruisers. It is an unpleasant outlook, but one which I am sure has to be faced, and the only way in which we can carry out this economy with the least damage is to ensure that the three services should cooperate in the closest possible manner and in complete harmony. The rumor and the generally-accepted belief is—and it is very unfortunate if it is true—that there exists neither this complete cooperation nor complete harmony, which is so necessary when there is so much to be done.

It follows, that if we accept the Air Ministry—and I believe we have got to do so whether we like it or not—and if the need for economy is urgent, indeed vital as I realize it to be—then we must make the coordination, correlation and cooperation, or whatever you like to call it, of the three services very real.

I want to expand this statement a little; I am not going to discuss warlike operations and the plans for them, we all know the history of Gallipoli and Antwerp and the necessity for joint formulation of plans for war—I want to confine myself to organization and maintenance in peace of such forces as may be necessary to give effect to the government's policy in peace and in war.

In peace, as I have said before, funds are limited. In war it is a different matter. If in peace, funds were unlimited then we could have a navy right up to the restrictions of the Washington Conference, we could have an excellent Expeditionary Force and Territorial Army full up to establishment, and an Air Force equal to meet any emergency. It is the business of the government to define the policy and the means, and relationship between the two, and it is the business of the Defense Services to make the most of every sixpence available, avoiding duplication and overlapping, and utilizing substitution of one means of defense for another wherever possible.

As I say, the Admiralty, within their own department, have already done something in this direction, in substituting to some extent cruisers for dockyards. Consideration should be given to the subject on a larger scale. Is there anything to be done in the way of substituting mobile for fixed defenses in our defended ports and bases? For the economic defense of an empire such as ours mobility of defense is essential. I doubt the advisability of spending much money in mounting 15-inch guns at Singapore, for example.

I only mention this as one example. I cannot help feeling that we are reverting passively to pre-war methods and ideas of defense, and merely superimposing a minimum of air defense on to our old arrangements. We have to look forward ten or fifteen years and lay our plans accordingly—these will be very lean years.

I feel that, admitting such conditions, we ought to pursue a policy of defense which rests on mobility, power of rapid expansion and research. It seems to me that there is great scope in the adjustment of a balance between the three services, but it requires the most careful and deliberate combined study of the general staffs of those services, working in close cooperation and harmoniously.

The British Empire is extraordinarily difficult to defend, but fortunately for us we have a large number of stepping-stones all over the world, making rapid movement and concentration possible. We ought to make the most of this.

Apart from the balance between the services there is also the question of the existing differences of opinion:

a) The first thing that enters one's mind in this connection is the controversy between the navy and the air in relation to the Fleet Air Arm. Why has not the army got an Army Air Arm, instead of Army Cooperation Squadrons? Are both the navy and the army satisfied with what they have got? Surely it is not beyond the power of the three general staffs to formulate some combined scheme which will satisfy the requirements of all three? I need not elaborate this further; the arguments are well known to us.

Again, I find in the Salisbury Committee's report a statement that in relation to the protection of maritime communications in the narrow seas there were revealed wide differences of professional opinion between the naval staff and the air staff, both in matters of principle and detail.

b) Further, I am told on all sides that there is great waste in the administrative services of the navy, army and air force by overlapping and unnecessary duplication. Of course, I refer to such departments as Medical, Chaplains, Pay, Contracts, Lands and the like. It is inconceivable to me that, for example, one Lands Department and one Contracts Department should not satisfy the requirements of all three services. Surely it is better to effect some economy here if economies have to be made, and be enabled to maintain an extra cruiser or a few more airplanes.

Is there any economy to be achieved in relation to questions of Recruitment Establishment and General Administration of the Fleet Air Arm and Army Cooperation Squadrons? Is there any possible means of reducing the ratio of ground men to each airplane? I have only mentioned a few of these points very casually; no doubt there are many more, but I think there is ample scope for much economy to be achieved.

Let me draw your attention to another aspect of imperial defense which will become, in my humble opinion, of immense importance in the future. I refer to the re-distribution of the population of our empire. I firmly believe that economic pressure at home will force people to migrate to the dominions in ever-increasing numbers in the years to come and that this will be the great feature in the development of the empire during the present century, just as the industrial development of Great Britain was in the last century. This is going to complicate the whole question of imperial defense so far as we in this country are concerned. The growing strength of the dominions will be a factor which counts and must be used in relief of the burden on the home country; on the other hand, the dominions are independent and it is only by encouraging them to come into our councils of defense that we can achieve any success. If we have a sound machinery and organization for defense and put our own house in order first, there will be much more inducement to our dominions to come in and lend us a hand in our heavy task. We should, from the outset, endeavor to obtain the advice of the dominions in all matters of defense in relation to all three services whenever possible.

I have cut down these preliminary remarks as much as possible, but I was anxious to make out some case for making four quite reasonable assertions:

First, the Air Ministry will remain as a permanent institution.
Second, there is a great and real need for economy.
Third, dominion cooperation will become of increasing importance.
Fourth, there are many points of difference between the three services and much scope for their joint consideration.

The first two of these are essentially matters for the politican to determine, and I think there can be no doubt as to what decision will be given.

The third, that is to say, the question of dominion cooperation, is a matter for the dominions to determine, but we can be quite sure that

the best inducement to them to come into our councils is to get our own house in proper order first.

The fourth is the matter with which I have to deal now, based on the assumptions which I have already made. It is a question largely for the services to determine themselves. It is for the services to give effect to the government's policy within the limit of the means available by the most up-to-date organization and efficiency, by research and by general excellency of staff work.

It would be quite easy for the services to deal with this problem if they could eliminate the politician, but in a democracy such as ours it is the politician who represents the will of the people. The administration of the country is vested in the prime minister and the Cabinet, and when you grumble at the politician you really grumble at our system of democratic government.

The prime minister selects the members of the Cabinet, and he is the ultimately responsible authority for determining the policy, the means, the question of peace or war, and the conduct of war.

The authorities in the services are, firstly advisers and, secondly, responsible for execution. In peace it is the business of the services to see that the best advice is given to the government on the most economical basis.

Before the war our interests were so scattered all over the world so technically complex, and involved so many questions of major importance, that it was deemed necessary to establish some machinery for crystallizing advice—a sort of clearing house for defense problems. The Committee of Imperial Defense was therefore established.

Since the war, with the advent of the air weapon, problems have become more numerous and more complex, and there were so many vital points of difference in controversy between the three services that it was almost the unanimous opinion of all responsible authorities that the machinery of coordination and corelation was insufficient and that the Committee of Imperial Defense, which had met very rarely since the war, was now inadequate for the purpose for which it had been constituted.

The subject was constantly raised in the House of Commons in the years which succeeded the war, whenever estimates were under discussion, and never failed to generate much heat between those members who had been intimately connected with the services. The result was that the government set up the Salisbury Committee in the spring of 1923; this committee reported in November of that year, and its recommendations were carried out.

I feel I must give you a résumé of the recommendations of the Salisbury Committee. There are certain landmarks in the history of our defense evolution, such as the Esher Committee, the establishment of the Committee of Imperial Defense, etc., and the Salisbury Committee is one of them.

Its findings may be reduced to four expressions of opinion and three recommendations. The four expressions of opinion are these:

1) Cooperation for protection of communication in the narrow seas should be the subject of further investigation in technical differences of opinion.
2) As regards Home defense, the menace of air attack has increased and that of seaborne invasion has decreased.
3) A Ministry of Defense is undesirable and impracticable.
4) The existing system of coordination through the Committee of Imperial Defense is insufficient.

The three recommendations were:

1) Definite members should be appointed to the Committee of Imperial Defense, including the three chiefs of the staffs.

2) The three chiefs of the staffs, in addition to their functions as advisers in relation to their respective services, should have an individual and collective responsibility in advising on defense as a whole and should form a super-chief of war staff. They should meet together to discuss questions affecting their joint responsibility.
3) The Committee of Imperial Defense secretariat should be increased by the addition of an air secretary.

As a matter of fact, the whole of these recommendations may be reduced to one item of supreme importance, namely, joint responsibility for the three services is intended to be imposed on each chief of staff who is also a member of the Committee of Imperial Defense. This joint responsibility, though visualized as a reality is more imaginary than real, for the chiefs of staff have no special staff to study jointly the many problems of supreme importance affecting the services. The Committee of Imperial Defense secretariat is only composed of three technical officers, who must obviously be ineffective for the purpose.

It is, however, the admission of the necessity for joint responsibility that I want to emphasize, and we must recognize that there is neither any real responsibility in this arrangement, nor is there any effective machinery for reaching well-balanced joint decisions.

The Salisbury Committee laid stress on the necessity for joint responsibility on the part of those responsible in the three services, but they did not clothe the War Office, the Admiralty, and the Air Ministry with any garments of joint responsibility at all. They simply stated that the joint responsibility should exist. Now I want to focus your mind on the question of this joint responsibility which has been stressed so much by the Salisbury Committee. There are no doubt many who say that it is quite sufficient if the three chiefs of staff meet occasionally and that the Committee of Imperial Defense secretariat is all that is necessary to draw up and record joint advice and recommendations. Personally, I do not think that this arrangement is by any means sufficient to handle the complex and important problems, some of which I have already alluded to; and in this view I think I am supported by almost every minister who has held a position of responsibility in relation to defense since the War. I will not trouble you with quotations from their speeches, though I have them here with me. All I am asking for is that this joint responsibility advocated by the Salisbury Committee should be made effective and not allowed to remain chimerical, as it is at present. The question is: How is it be achieved?

Many responsible authorities are of opinion that the existing conditions necessitate the establishment of a Ministry of Defense. Two of these authorities are the Geddes Committee and the present Chancellor of the Exchequer. In addition I have heard the same opinion expressed by many responsible senior authorities. I must admit for my own part that the suggestion of a Ministry of Defense appears at first sight to be very attractive.

The views of the Chancellor of the Exchequer are represented in his speech in the Commons:

"No solution of a harmonious or symmetrical character will be achieved in the coordination of the services except through the agency of a Minister of Defense, but it is not possible to create such a body at the present time, nor will it be possible for a considerable time to come."

The Geddes Committee was set up in order to obtain economy, and their idea was to have a Secretary of State with three Sub-Ministers who should be responsible, respectively for the Admiralty, the War Office, and the Air Ministry, and preside at the Board of Admiralty, Army Council, and Air Council. The Secretary of State was to have his Defense Council,

consisting of the Sub-Ministers and two members each from the Board of Admiralty, Army Council, and Air Council.

It is remarkable that the ideas of the Geddes Committee coincide, to some extent, with the arrangements of the Italian Government. Where there are three ministries there must also be some machinery for the coordination of those ministries.

There are other authorities who recommend the Defense Ministry, but to those who are particularly interested in this subject I think the most useful and instructive statement on the political side is he report of the Sub-Committee on "Machinery of Government," presided over by Lord Haldane —this was a Sub-Committee of the Ministry of Reconstruction set up during the War period. It shows up an unwieldy Cabinet of twenty-two members and points out the advantages of reducing the Cabinet to twelve members and how that might be achieved. One particular item in his recommendations was the combination of the three services under one ministry.

I do not know if Lord Haldane does now, as a matter of fact, advocate a Defense Ministry, but in any case a pamphlet or report on the re-adjustment of the machinery of government does not mean much to us in this connection at the present time, for the simple reason that any drastic adjustment of governmental machinery is very difficult to achieve, and, at the best, is a very lengthy process. We have the example of obviously necessary reform, such as that of the House of Lords; this has been talked of for many years, but nothing has yet been done. I feel that at the present moment there would be an overwhelming opinion in Parliament against a Ministry of Defense. If such a ministry is really necessary, we require to prove our way gradually by a process of evolution.

The stock argument against a Ministry of Defense is that it would put too much power into the hands of one minister, and that not the prime minister, who is the responsible authority. This would be the case in peace in relation to finance, and in the event of war it might prove a positive danger. We are asked to imagine an efficient and powerful Minister of Defense with an effective administrative organization behind him. We are told that he would certainly be a rival to the prime minister and that this would open out every conceivable chance of friction. It is further asserted that such an arrangement would not work in peace because the minister would have too great a hold over finance and it would not work in war because the minister would be in a position almost to dictate to the country.

I will not say that a Ministry of Defense will not be the eventual solution. It may prove to be so. But we shall have to go through several evolutionary stages, not only in relation to defense arrangements, but also in the whole subject of the machinery of government.

Let me now come back to the question I put to you originally, at the beginning of my remarks: "Is there really any necessity for change in our organization and machinery for defense and in our system of control and coordination?"

My answer to that is, most emphatically, that there is a necessity for change, and that we must find some method of making the joint responsibility of the three chiefs of staff more real and effective, and that the oft-proposed solution of a Ministry of Defense is as yet impracticable.

It sounds very easy to find some way of achieving this desired degree of joint responsibility, but when your solution must be found in that borderland where service and political responsibilities meet a satisfactory solution is very difficult and one has to tread warily. One must respect the susceptibilities of the politician and be careful not to poach on his preserves.

In addition, there are departmental prejudices and strong feeling in the services as to their respective inviolability. Furthermore, there is a great

mass of opinion in the navy and army that the Air Ministry has no right to existence at all. All this does not make for well-oiled cooperation, and no joint responsibility will be really effective unless it is accompanied by the spirit of whole-hearted cooperation.

There is the old saying "United we stand; divided we fall." In these days, when the masses are clamoring for disarmament and reduction in naval and military expenditure, how important is it for the three services to put forward their joint views, well reasoned, well balanced, with one voice and with the full sense of their joint responsibility.

The politician knows how to play with dissensions and controversies. I have already said that the Salisbury Committee reported under one heading, "The enquiry revealed wide differences of professional opinion between the naval staff and the air staff, both in matters of principle and detail." It is quite easy to conceive conditions under which a House of Commons might make use of divergent technical views and cut down estimates below the level of safety. The ordinary politician is ignorant in matters of defense and naturally relies on the technical expert.

I cannot help thinking that that man, however able he may be, who makes cooperation difficult because of some ardent prejudice against the existence of an Air Ministry, is doing a great dis-service to his country. It is his business to accept the data which is given to him and to produce the best result. It is not his business to cavil at the data. If his advice is not accepted he can always resign.

It seems quite patent to me that the one thing we have to do is to clothe the three services with some real joint responsibility, and the way I would suggest for your consideration is:

First, that when any officer is offered the post of Chief of the Staff, whether in the Navy, the Army or the Air Force, it should be clearly defined that his responsibilities are not confined to his own service, but that he should accept a specific measure of joint responsibility in relation to the major questions of Imperial Defense as a whole.

Second, I think it is desirable that each Chief of the Staff should be called upon to sign Vote "A" of the Estimates of all three services.

Third, that in order to give due consideration to the joint problems of defense a special section of the Operation Staff—naval, military and air—should be set up by the three services, together under one roof, working day in and day out. In such a manner the three Chiefs of Staff be able to give well-balanced and unanimous recommendations in the Committee of Imperial Defense.

The first step would be to see how such an arrangement worked. I think I can visualise the possibility, even the probability, of some agreed solution to the question of the fleet air arm and army cooperation squadrons being submitted to the Committee of Imperial Defense. Furthermore, suggestions might be put forward regarding the amalgamation of certain administrative services. The estimates might even be considered jointly. I do not want to define what the duties of this Joint Staff Section would be, but they would be of vital importance and multifarious.

In viewing the progress of an arrangement such as I have outlined it would then be for consideration as to what the next step would be. Would it lead in the direction of a Ministry of Defense? It is quite possible. Would it lead to the fusion of administrative departments? It is quite possible. It seems to me that some joint thinking body, such as I have outlined would be the forerunner of a Joint Council of Defense, which would in its relationship to the Committee of Imperial Defense act entirely in an advisory and technical capacity.

There is nothing revolutionary in this. It appears to me to be ordinary common sense and practical logic. What do we find in business today—in fact in any line of life? We find combinations and amalgamations. It

seems to me, therefore, that my proposals are very parallel to what has been achieved in other lines of life.

You all know the report of the Esher Committee; you all know the history of the Committee of Imperial Defense. Nothing is static in this world. However much we dislike it, we have got to move in some direction, and I believe my suggestions are normal movements; indeed, logical movements in the process of evolution.

I know very well from long service in the army the type of conservative mind which says "Stop where you are. We want no interference by the politician. We want no Air Ministry."

I would ask that type of mind to consider the requirements of the present day in conjunction with our financial stringency and democratic evolution. It is of no value to the service or the state to live in an imaginary paradise.

Certain Aspects of Air Defense

The Journal of the Royal United Service Institution, February, 1926.—The air as a military weapon is still in its infancy, and we know that there may be vast changes and developments impending. The data of past experiences is very limited, and to a certain extent conflicting, and if there are, as there must be, a number of principles which can be legitimately evolved and deduced, this is not the place, nor am I the person to enunciate them. You will observe that the title has accordingly been changed from the "General Principles" to "Certain Aspects," and it is a few of these aspects to which, necessarily briefly and incompletely, I would draw your attention.

I propose to divide this lecture roughly into three parts. The first will be to give a few general points which may be of special interest to you. The second, certain details as to the actual forces and composition and development of the Air Defense scheme (and you will realize that for professional reasons these details must necessarily be of only a general nature), and thirdly, any conclusions or deductions which may appear appropriate.

The very term "air defense" necessarily calls up the idea of invasion. Almost certainly there is no nation in the world which is so ill-equipped mentally to face squarely the issues of invasion. If there is anything in heredity, and who can doubt it, then there must have been bred in us, steadily and in increasing measure, through many generations, this sentiment of immunity from external attack which even in Shakespeare's days was a national boast.

> "This England never did, nor never shall,
> Lie at the proud foot of a conqueror."

Forgive me if at the very outset I seem to be digressing aimlessly, but I can promise you that if it is a digression at all, it is entirely intentional. I think that the apathy and absence of real appreciation of the issues of air invasion are due more than we realize to this almost unconscious mental heritage of freedom from external invasion. It needs a few sledge-hammer facts before we can break down our old conceptions and substitute new ones. The most that can be said at the present moment is that there is a tendency to talk glibly of the Air Force having become the first line of defense without any very clear realization of what is implied.

I think as the peaceful years go on the futility of this attitude of putting new wine into old bottles will become increasingly clear. If the years are peaceful the change may well be a gradual revolution in outlook and in organization (just the same process as will be the social revolution which the milder of our political extremists promise us), but, if the years are not peaceful the revelation of the changed form of warfare will come as a flash, and we should do what we can in these relatively early days to

ensure that it does not come as a devastating flash so far as this country is concerned.

I suppose that almost the earliest reverence which was implanted in every decent English boy in the countless years before the war was the reverence for the achievements, the invulnerability, the might, majesty, dominion, and power of our navy. It was entwined inextricably in every sentiment of patriotism. The lore and language of the sea permeated into districts far removed from it. It became part of our everyday speech. We talk about "plain sailing," "sailing near the wind," "taken aback," "till all's blue," and a hundred other phrases which are so much part of our everyday speech as almost to conceal their nautical origin.

It comes as a shock to us to realize that the sea in a few years (in the twinkling of an eye, as we view the history of nations), has changed from our sure defense and bulwark to conceivably our greatest enemy. The sea in the future cannot save us from invasion, in certain circumstances it might conceivably starve us. And in making a statement like this, I do hope that it is unnecessary to say that there is not camouflaged in it a single vestige of a criticism of the senior service whose vital functions with regard to the safeguarding of our food and commerce remain unchanged.

If the fundamental conception of the sea with regard to England has been changed, it has been due to an elemental fact like the conquest of the air, and to that alone.

And now let us very briefly consider the idea of invasion with respect to the land. It is, of course, not true to say that the possibility of invasion has always been considered entirely remote by statesmen and leaders in the past. The Martello towers round our coast are witnesses to the contrary, and even in the Great War through which we have passed, it is common knowledge that the most minute and elaborate schemes were prepared to meet invasion; but I think it is safe to say as regards the latter case, that these preparations were made with an idea of meeting an unlikely possibility rather than a probability, still less a certainty. The picture for the future is a very different one. The invasion which we must accustom ourselves to regard as a certainty, in the event of war with any continental nation with a large air fleet, is very different from the Napoleonic bogey where the manhood of the nation fighting on its own soil might be trusted to give a good account of itself against a few thousand enemy who had managed to elude the vigilance of the navy.

The invasion which will be a daily, and probably a nightly occurrence for certainly a few days, in the event of future wars, will be a drastic visitation of which the worst of the air raids during the last war must necessarily have been but the veriest foretaste.

And now, having accustomed ourselves to the idea that any great continental war in the future will entail invasion as opposed to the relative immunity of the past, we should do well to consider one or two of the salient and peculiar features of air invasion—and here again we have a complete breaking with the lessons of the past. Experience has shown that no matter how perfect the mobilization arrangements of armies may be, the first few days after the outbreak of war have nearly always been marked by hostilities on a relatively minor scale. The reason is obvious. Vast concentrations of men on the actual frontier would be regarded as a provocative act, and consequently there has always been a certain lull before hostilities on the grand scale have commenced. With air action it is otherwise. The pilots are ready, so are the machines. It takes but the pressing of a button, so to speak, and the first and greatest raid of the war will be under way.

The other salient difference is even more obvious. The land forces of a country, and the naval forces and the air forces have all got one common end in view, but they achieve that end in different ways. The end in

view is to supply the necessary means by which their government can impose its will on that of the enemy. but the main objectives are different. The main objective of the army is necessarily to defeat the army of the opposing nation. The objective of the navy is a similar one, in addition to safeguarding our vital lines of communication. The objective of the air force is to paralyse in every way possible the enemy's power and will to war. This is not the place for a strategical discussion, but it must be realized that the main objective of an air force in war will not be solely or even primarily to search out the enemy aircraft with a view to destroying it. Such a procedure may be inevitable, and may be possible, but so far as the future of air warfare can be foreseen it is anticipated that the main air effort will be against those centers of vital importance on which the enemy depends to carry on war—and that conclusion takes us one step, a very tragic and disastrous step, further.

These main centers of communication, the actual seat of government, the great railway stations, will nearly all be found adjacent to and in great cities. The bombing aircraft of the enemy will be attacked by every means possible by defending aircraft and by anti-aircraft shells. It is only too obvious that the bombs dropped legitimately enough on war-like objectives will be so widely dispersed as to be a continuous menace to the whole population. This brings me to the second salient difference in air invasion.

War in the past, if one excepts the great barbaric wars of antiquity, has been, to a certain limited extent, some respecter of persons. Steadily, in recent centuries, it has had a tendency to involve more and more in its grasp. One reads in the past of armies doing battle by the simple spectacular and economical method of choosing a champion of each side, and on his individual prowess the issue of the day depended, and then for many years right from the middle ages to the Peninsular Campaign, we have the example of comparatively small armies waging long and bitter wars without any overwhelming effect on the general life of the nations involved. The last war brought numbers directly and indirectly into the conflict on a scale for which there was no precedent and it is much to be feared that the development of air warfare will give irresistible momentum to the tendency which we have traced.

It cannot be foreseen that anybody will be exempt, women or children, aged statesmen or active indispensables. In the universal realization of this fact, perhaps lies the greatest assurance of peace in the future. At this stage I must conclude the first part of this lecture.

An effort has been made to show the absolute necessity for regarding invasion as an integral part of any great continental war in future. and also to point out that air invasion differs from land attack in that it may be expected to reach its maximum intensity at the very outbreak of war, and also that it threatens to involve the whole nation, irrespective of sex, age or employment. But I feel that before going into any brief detail as to the actual preparations of the Air Defense scheme, it is essential that you should be convinced both of the danger and the necessity. I feel that I cannot end this part of the lecture better than by quoting the dictum of the one soldier of our day who, from his professional attainments, both in the field and academically, and also from the unique position which has enabled him to gain the broadest grasp of the aspects of modern war, is perhaps the most supremely fit of all to express a definite opinion. It is hardly necessary to say that Marshal Foch, the recent Generalissimo of the British and French Armies is referred to, and his statement on the subject has so often already been repeated as to be almost a classic, and has never been seriously controverted:

"The potentialities of aircraft attack on a large scale are almost incalculable, but it is clear that such attack, owing to its crushing moral

effect on a nation, may impress public opinion to the point of disarming the government, and thus become decisive."

In considering the actual scheme of air defense, I am sure you will understand and appreciate the reasons which compel any lecturer to be most guarded in imparting any information which may be considered as of a secret nature, and I need hardly ask you to make full allowances for the difficulty in which I find myself in this respect. I feel that we will have to delve back a little bit into the past in order to gain a proper perspective of this scheme of air defense.

At the end of the war we had no fewer than 200 service squadrons abroad. We had an equivalent of 199 squadrons at home for training and reserve purposes.

Within two years of the Armistice we had fallen to our low water point. We had then only twenty-eight squadrons. Of these twenty-eight squadrons absurd through it may seem, only one squadron was available for Home Defense.

Eight squadrons were in India, seven were in Egypt, three in Mesopotamia, and five serving at home and abroad with the navy. Of the five remaining, two were army cooperation squadrons, one was on the Rhine, one was for communication, leaving the magnificent total of one for air defense.

We are not concerned with the political action taken as the result of this state of affairs. It is sufficient to say that it was first agreed that the home defense allotment should be raised to fifteen squadrons, and that subsequently it was fully realized by the government of the day that this allotment was entirely inadequate, and that it was then raised to the present figure of fifty-two squadrons.

In framing the home defense scheme, the Air Ministry decided to submit a program which would fulfil the following three principles:

a) The forces to be provided should be sufficiently strong to afford adequate protection against the largest air force within striking distance of our shores.

b) The defense forces should be so organized as to admit of any subsequent expansion found necessary.

c) In order to combine a reasonable standard of efficiency with a maximum of economy, and at the same time to facilitate the process of expansion, it was decided to frame a certain number of special reserve and auxiliary squadrons.

The following are some of the points which it is legitimate to mention with regard to the fifty-two squadrons which have been allotted for home defense: The process of expansion is in full swing at the present moment. It will be obvious to you that these fifty-two squadrons will be of different types.

First there are those squadrons which are earmarked for purely defensive purposes, *i.e.*, for attacking the enemy aircraft on their raids to London and other objectives. The other portion of the force will be offensive squadrons which will be directed to seek out those of the enemy objectives, the destruction of which will most paralyze him in the conduct of the war.

Let me deal first with the first type, *i.e.*, with the fighter airplanes which are used for defensive purposes. These will, normally, consist of small single-seater machines with a very high performance, *i.e.*, with great speed, a good ceiling and absolute power of maneuver, all of which are essential if they are to be in a position of superiority when attacking the enemy bombing machines.

While it is not desirable to give the exact number of defensive squadrons or their exact location, it is, however, permissible to say that

they will, in general, occupy a zone some thirty miles from the southern and eastern coasts. And straight away I would like to anticipate an obvious criticism of this location. It is obviously not an ideal location—an ideal location would be on the coast line, so that the enemy could be engaged before ever they came to England.

Perhaps a very simple military analogy will serve best to explain the reasons which, for the present, at any rate, have necessitated a location somewhat in rear. It is no use your taking up a military position which provides you with a magnificent field of fire which is in itself almost impregnable, and which combines every other military advantage, except that the enemy need not encounter it in order to attain their objective. In other words, no position is any good which does not enable the army, or the air force alike, to fulfil its raison d'être. The raison d'être of the fighter squadrons, put as briefly as it can be, is to engage, and as far as possible, to defeat the enemy bombers before they reach their objective.

What is the height at which the enemy bombers will come? What is their objective? What is the period of warning which we may reasonably expect? What is our rate of climb? We may expect the enemy to come over at any height up to 25,000 feet. We must count on London, with its limitless targets, as being probably the main objective. We cannot, in the present state of the science of detection of enemy aircraft, count on more than thirty to forty minutes' warning.

The last thing that you will want is that this lecture should be degenerate into a mere elementary mathematical problem, but I think that the figures which I have just given you will show you that the necessity for locating fighter squadrons well back from the coast is one which is forced on us by facts which are incontrovertible at the present stage of aircraft development.

I do not want for one moment to mislead you into the idea that all the fighter squadrons will be in this belt some thirty miles from the coast. There will be others, and they will be well thrown forward. It is to be hoped that by their specialized training they will be able to carry out the most valuable duties. They may be able to break up and defeat, or at least delay the enemy bombing formations. They should in any case be able to give very early and reliable information to the main defenses in rear, and they should be in a supremely suitable position to inflict very heavy casualties on the enemy bombing formations on their return from their objectives.

Needless to say, it is most fully recognized that the offensive handling of our defensive measures is in the highest degree essential, and every scientific development which will permit of the air battle being joined as early as possible will be most fully exploited.

I have mentioned this detail of air defense at some length because it emphasizes a most important general lesson. The development of aircraft precludes a scheme which is definite and fixed, and the necessary embryonic stage of development of air tactics and strategy precludes anything in the nature of watertight and doctrinaire theories.

I mentioned earlier that the two main divisions of the squadrons employed on this scheme for the protection of Great Britain were fighter squadrons and bombing squadrons. Again, it is not permissible to give the exact number of squadrons which are earmarked for the bombing purpose, but it is safe to say that the number of bombing squadrons is very considerably in excess of the fighter squadrons, and here again I would like to meet frankly two points which will doubtless appear to you as obscure.

These bombing squadrons will be grouped into three main divisions, both for convenience in strategical and tactical handling and for administrative purposes. These three groups will be described as East Anglian,

Wessex, and Oxford Areas. Again you may say—surely it would be better to have these bombing squadrons on the coast in order that they should be as near their objective as possible.

It may be of some interest to you to realize briefly the reasons which have prevailed in the selection of these areas.

The first consideration must, of course, be the technical or topographical one. In other words, it is quite useless to select an area which is strategically ideal as being close to the enemy objective and which is tactically satisfactory as being difficult for the enemy to locate and consequently to bomb, but which fails to fulfil the primary and essential condition from the flying point of view of supplying good airdromes suitable for large airplanes to land by day and night.

From the above, you will observe that there are three main considerations which may be borne in mind. The various airdromes must be topographically suitable, they must be strategically suitable, and tactically they must not be unduly exposed.

It is, of course, impossible for me to discuss in any detail the reasons which have prevailed in the choice of any specific areas. It is, however, safe to say that the importance attached to the rôle of these bombing aircraft in the early stages of a war is so great as to necessitate every reasonable endeavor being made to save them from being too much exposed to enemy attack.

But I mentioned that there would be another ponit on which you would doubtless require information. It is in reality a much more important point. It reaches far down to all basic considerations of the future of air warfare. Put briefly, it is—"why should it be necessary to earmark in a scheme which is essentially defensive, the greater proportion of your forces for offensive measures?" In other words, "why should not all the squadrons be earmarked for that rôle of defense which, after all, most faithfully reflects the peaceful aspirations of the nation at large?"

I will not for one moment attempt to deny the attractiveness of this point of view. If only the alternative which it provides was remotely practicable, any other course of action would be indefensible. The pity of it is that it is entirely impracticable. It is unfortunately, only too easy to show wherein this impracticability lies.

The whole difficulty turns and hinges on this question of a third dimension. The third dimension is nowadays such a common phrase that it is almost in danger of becoming hackneyed and thereby losing its significance. Perhaps another way of describing it may be more convincing. The battle zone of the air may be imagined to stretch up to any height, say 30,000 feet, and it may be divided up arbitrarily into any number of smaller zones, say 500 feet in depth. There you will have sixty separate zones. It may not do to press the parallel too closely, but it does serve to bring home in a very trenchant way the enormous and almost incomprehensible basic difference between maneuvers in the air and on the ground.

But if the problem of locating and engaging the enemy aircraft could simply be reduced to making allowances for the third dimension and the speed of the airplanes involved it would be comparatively simple compared with the actual position. When one realizes the cloudy weather and the partial mists which prevail in this country for the majority of the days of the year, together with the certainty of many of the enemy attacks being launched at night, it will become apparent that the endeavor definitely to locate and engage enemy bombing attacks is one of the most extreme delicacy.

We may confidently hope that our fighter squadrons will be so trained and that scientific appliances will be so improved as to increase materially the chances of this contact being obtained. But the fact remains that,

humanly speaking, it is impossible to deny that on a considerable number of occasions, when the climatic conditions are really favorable to concealed advance, the enemy bombers will occasionally be able to elude the vigilance of the defenders.

I mention this point not with any idea of striking a note of pessimism—in fact, quite the contrary. It is merely to emphasize that air warfare is like all other forms of warfare in that it confers an enormous advantage to the offensive. The future of air strategy is, admittedly, undecided, but it is safe to make one statement without any fear of future contradiction, and that is that any scheme of air defense which provided in the main for the defensive action as opposed to offensive action would be absolutely foredoomed to failure.

Up to the present point in this lecture I have only dealt with the broad air divisions of this scheme of home defense—but any lecture would be obviously inadequate which did not refer to the part played by the ground organization.

The ground organization may perhaps be divided into four categories:

a) Anti-aircraft provided by the Royal Artillery.
b) Searchlights provided by the Royal Engineers.
c) Acoustic and scientific developments generally provided by military and civilian experts.
d) The observation system for transmission of information.

Time will only permit me to deal very briefly with these subdivisions, and there are naturally many who by virtue of their specialized training could do so more thoroughly than I can hope to do.

The functions of the anti-aircraft ground defenses are direct and indirect. They hope and expect to take a toll by direct hits on bombing aircraft, but in addition, they are of very great value in forcing the bombing aircraft to fly at a greater altitude, in generally disturbing the accuracy of their bombing, and also in indicating by their shell bursts potential targets for our single-seaters.

I have mentioned quite frankly the difficulty of the fighter squadrons in locating the enemy bombers, and the main basic difficulty which concerns the anti-aircraft gunner is even more obvious.

Under existing circumstances, it takes some thirty seconds for a shell to reach 20,000 feet. This does not sound enormous, but when you consider that the target at which it may be aimed travels at perhaps 120 miles an hour, it becomes obvious that it will have moved a mile during the period of the flight of the shell.

The sighting apparatus which enables the necessary calculation to be made automatically and almost instantaneously is an ingenious one, and the recent experiments made by the anti-aircraft units in firing at a mobile target suspended from an airplane have been most interesting—but when you consider the often indifferent visibility, the enormous height, the high speed, and the small superficial vulnerable area of the target (some two square yards) you will realize some of the difficulties which confront the direction of anything approaching accurate anti-aircraft fire.

The rôle of the searchlights, put very briefly, is to discover and to illuminate the attacking bombers and expose them as targets both to the anti-aircraft guns and our own aircraft. They are absolutely essential to any scheme of defense in which air attack by night must be reckoned on.

There is little doubt that searchlights have made and will continue to make, great strides in the picking up of enemy aircraft, but here again, it is useless to deny that they are up against one of the great factors which makes the work of single-seater fighters so amazingly difficult, and that is the foggy and cloudy weather which is all too prevalent. A comparatively thin bank of cloud entirely blankets the searchlights, with the result that they are unable to carry out their primary function.

With regard to (c) and (d), the acoustic and scientific developments generally, and the system for centralizing and colating information with the very shortest delay, it is impossible for me to go into in any detail. The results obtained are of a most interesting and secret nature. The developments of air tactics and air strategy may largely be affected by them.

And now in conclusion I would beg your permission to end this lecture on another note, and to emphasize two final points.

An effort has been made to show honestly and without exaggeration the difficulties, many of which we hope to overcome, of air defense in its strictly literal meaning—and of the absolute necessity of having earmarked a strong offensive contingent. But this is not all. No matter what are the defensive arrangements, there can never be a question of a guarantee of immunity from air attack.

In future wars, one side or the other will have superiority in the air—it must be our object to win it. But there will not be anything so definite as a supremacy of the air—the proud title which we have been accustomed to apply to the sea. What follows, and what is the result? It follows that victory will come to the nation which in an air war in the future has not only the strongest striking force, but which shows the greatest stoicism and ingenuity in meeting strange and devastating terrors.

And last of all, in this Institute, of all places, where cluster thick the banners and the trophies and the memories of every part of the empire in every age, it is perhaps just and appropriate to emphasize that a real scheme of air defense is not a mere selfish national consideration, but is, in fact, the strongest link in the great and delicate chain of empire.

We stand at the parting of the ways, between the wars of the past—and the wars, if they come at all, of the future. And the main difference is this:

In the wars of the past the outposts have died in order to give the nation time to repair the deficiencies of peace—in the wars of the future, a blow from the air will fall on the heart of the empire, and we must see to it that the outposts do not die for a second time because the heart of the empire is dead.

FRANCE

The Industrial Progress of France

Engineering, 19 February, 1926.—There are occasionally convalescents who puzzle their medical attendants by erratic and unaccountable variations in temperature, though they may be at the same time making steady progress towards complete recovery. To a patient of this class our neighbor, France, might well be likened; for the fluctuations of the franc and her feverish political atcivity appear to be directly contradictory to the rapid strides she has made from the wounds and exhaustion of war, to physical well-being. Indeed, in many ways her losses seem to have imparted greater vigor. An unbiassed account of her present condition, such as is to be found in one of the recent reports issued by the Department of Overseas Trade, makes illuminating reading. This is entitled, "Report on the Economic and Industrial Conditions in France," and is by Mr. J. R. Cahill. It is revised to July, 1925. It may be contended that the present remarkable industrial activity of the country is based upon an insecure financial foundation. This is a question with which we are not for the moment concerned. Whatever the foundation that activity is of very direct interest to this country and to British manufacturers.

One of France's serious industrial handicaps has been a shortage of potential motive power. In the case of coal, this shortage was physical; but, in the case of water power, has been rather due to lack of development.

In 1913, France—not, of course, including Alsace-Lorraine—consumed 64,000,000 tons of coal. Of this nearly 41,000,000 tons were produced in the country. Alsace-Lorraine, though a producer, is relatively a greater consumer, and the total consumption for the whole area for 1924 is set at 75,000,000 tons, Alsace-Lorraine production being placed at 5,250,000 millions. The difference of about 29,000,000 tons between total production and total consumption was made up by importations, in which Great Britain shared to the extent of 11,400,000 tons in 1913.

The present rapid industrial expansion in France does not, necessarily involve a greater consumption of coal, for the use of oil and of water as sources of power is rapidly extending. Again, the collieries damaged by war are being re-started under greatly improved conditions, and though all are not yet in full operation, it is evident that their output has been considerably increased, and is capable of still further expansion. It would seem possible that the national output can be raised, if desired, by from 8,000,000 to 10,000,000 tons over the 1913, figure, certainly, under normal conditions a further 5,000,000 tons are obtainable. It is thus very doubtful whether the British imports of that year will be exceeded in the future, even if they be maintained. In this connection it may be noted that in the first six months of 1925 these imports only amounted to 5,000,000 tons. The effect of France's increased home production has additional force because of the decreased demand due to recent developments. Of these, examples may be found in the spread of electrification on the French railways. The Midi Railway has already about 630 miles of line under hydro-electric power, and in the near future the Paris-Orleans Railway will be opening water-power stations which will dispense with the use of coal for two busy stretches totalling nearly 600 miles. This work was dealt with in M. Parodi's paper, read before a joint meeting of the Institution of Electrical Engineers and the British Section of the French Society of Civil Engineers last night, and which we hope to deal with more fully at a later date. These electrifications involve, as a rule, the whole district through which the line passes, so that private and public lighting, heating and power plants near the line, at present operated by coal, will also cease to be customers. The mines, especially those damaged during the war, have been equipped in the most modern and effective manner, including improved plant capable of a more rapid production of patent fuels, coke and by-products. With the increase in the area in which metallurgical industries are carried on, coke has become a more important factor. In 1924 5,400,000 tons of coke were imported, as compared with 3,000,000 tons in 1913, in spite of developing home production. Great Britain only provided 53,000 tons of this, and the first six months of 1925 show a decline, our contribution for that period being only 19,800 tons.

The advances made in the output of iron and steel have been very great. In 1924, France exceeded the British output of pig-iron, the monthly averages being 625,000 and 610,000 tons respectively. In the first six months of 1925, both the pig-iron and steel figures show a further increase and at the end of this period they had passed the combined output of France and Alsace-Lorraine for 1913. The export trade has kept pace with production. For the first six months of 1925, pig-iron and castings were exported to the amount of 332,000 tons, a very great increase on previous figures. Rolled or billet steel was exported in the same period to the amount of 923,000 tons, of which Great Britain took 184,500 tons. It is estimated that France must export at least half of her normal production of iron and steel. A cheap and regular supply of good metallurgical coke is therefore essential to success.

The engineering trades have all prospered in recent years. This is particularly the case as regards the motor-car electrical industries. If there was any disappointment in this period of prosperity it was with the

locomotive builders, who have not been so fully occupied as they might otherwise have been, due to deliveries of engines from Germany and to the adoption of electrification schemes. Apparently, however, this industry is building up a good export trade with the East. Shipbuilding and ship-repairing yards have been so busy that occasionally a labor shortage has been experienced. The work in hand has included vessels for the French Navy. On March 31, 1925, thirty-seven steamers were being built in France for the mercantile marine. The foreign orders secured were important in 1924 and 1925, both in quantity and size, Holland, Finland, Norway, Brazil, United States, and others being customers. The French shipping companies have been adding to their fleets and converting coal-firing steamers to oil fuel. In this connection it may be noted that the oil-carrying fleet of France has increased ten-fold since 1918, and now amounts to about 250,000 tons. The total French tonnage is at present 70 per cent greater than in 1914, and she occupies fourth place in the world's mercantile marine, Great Britain leading with 19,000,00 tons, then the United States with 12,000,000, Japan 3,700,000, and France 3,400,000.

As with the mining industries, the engineering trades seem to be in a better position technically than before the war. Re-equipment with modern machine tools and appliances has been carried out in a very lavish manner, while standardization and mass production have been largely developed. New and larger factories have replaced those destroyed, in some instances this having been facilitated by combinations between former business rivals. This has somewhat reduced competition and improved production by lowering overhead charges on more fully-occupied works. In the sugar industry, for instance, 148 factories were destroyed and it has been possible to replace 110 of these with only fifty-one, having a greater combined total capacity.

The industrial position of France has been further changed since the war in two ways; one, by the more careful study of the manufacturing methods of other countries, the other by attracting branches of well-established industries from such countries to her own land. The interchange of knowledge between allied countries gave an impetus to the production in France of high-speed and other special steels. Now, with her great water power resources providing cheap current, she is one of the foremost producers of electric steels. Her chemical industry is capable of producing about 600 synthetic dyes, nearly all the subject of German secrets before the war, and she is not by any means behindhand with other chemical processes. The high customs tariffs have resulted in the settlement in the country of many large manufacturing firms, among them being British, American, and Scandinavian businesses, covering a wide variety of industries, while larger imports of finished parts for assembly in France, are to be traced to the same cause. The low rate of exchange at present obtaining may, of course, play some part in attracting foreign capital. Progress is steadily being made in the direction of both consolidation and combination of firms engaged in the same business, and these changes are at work in the "vertical" direction also. The electrical firms afford interesting examples of the tendency to amalgamate among companies, which previously competed with each other.

France is engaged on far-reaching schemes as regards her inland waterways. The Marseilles-Rhône canal, with its 7 km. tunnel is expected to be in use in the coming summer, and industrial progress will no doubt be rapid along its course. The Alsace grand canal which is to run parallel with the Rhine for some seventy miles has now reached the stage of approval of the final plans. An important scheme for rendering the Rhône navigable as far up as Geneva is also receiving consideration. This scheme combines with navigation the production of about one million horse-power and the irrigation of considerable parts of Provence. It is easily under-

stood therefore, that preliminary organization is a lengthy task. Nearly every harbor in France is the subject of improvements of one kind or another. Rouen is now one of the best equipped ports for coal handling in Europe, and fresh docks are contemplated for the exclusive use of oil traffic. Grain handling facilities have been greatly increased and a new quay is in hand. Marseilles has a program of 40 to 50 years' work in front of her, chiefly in connection with breakwaters and moles. Work to be immediately taken in hand at Bordeaux consists of the construction of a large warehouse, and the completion of, what it is claimed will be, the largest transporter bridge in the world. Electrification of port equipment is also contemplated. St. Nazaire is to have extensions made to its dry docks, and a new one is to be constructed, 1,740 ft. long. Activity is also evident at Havre, Boulogne, and other ports.

The most outstanding developments in French railways apart from electrification lie in the direction of communication with other countries. Thus there are three Transpyrenean schemes afoot to couple French railways with those in Spain, and one is mooted for a new Franco-Italian line. Though now part of France, important improvements are being carried out in improving traffic facilities with the formerly relatively inaccessible territory of Alsace. As regards oil, boring in French territory is being actively pursued, and a determined effort is being made to reduce the dependence of the country on foreign supplies. Importers of oils are compelled by law to purchase annually a certain quantity of home-produced industrial alcohol for blending purposes, the quantity of this spirit produced at present being beyond the capacity of consumers. Apart from this, great attention is being paid to such questions as the possibility of producing synthetic petrol on a commercial basis, great quantities of peat and lignite being available. The output of minerals other than coal and iron ore shows a large increase over 1913, potash salts from the added territories being responsible for much of this.

French Navy Notes

The Naval and Military Record, 17 March, 1926.—Minister Leygues has survived our latest ministerial crisis to the great satisfaction of all friends of the navy. Continuity of views and of work is assured by Admiral Salaun, our Acting First Sea Lord, and by the go-ahead Admiral Pirot. A new "navire-école" for officers, of some 6,000 tons, is to be ordered to replace the old *Jeanne d'Arc;* roomy quarters and up to date training appliances are to be her features. Bona fide fighting ships would have been more welcomed. Luxury and comfort on board sum up Minister Leygues' recruiting policy. Patriotic propaganda, as in Great Britain and in Germany, would yield far superior results, but it is incompatible with our Republican ideals.

The shortage of trained personnel is causing anxiety in responsible quarters. The thirty new units completing only represent 60,000 tons, but they make a far greater demand on officers, petty officers and specialists than would have done a similar tonnage of battleships and cruisers. Raw recruits, who are useful on board large ships, are a nuisance, when not a danger, on board large complicated submarines and destroyers, as show recent breakdowns traceable to inexpert handling. The Navy receives yearly some 5,000 inscrits maritimes(seamen) and trained professional boys, plus 4,000 volunteers—numbers totally insufficient. Some 8,000 eighteen-month recruits have compulsorily to be incorporated into the navy, where they are little more than make-believe matelots, leaving the service at the moment they are getting efficient—a system incompatible with bona fide sea power. Fine ships without seamen are "poudre-aux-yeux," as history conclusively shows.

France means to preserve the lead in destroyers. The 2,650-ton *Lion*, just ordered at Dunkirk will develop 65,000 h.p., with new type boilers, do at least 36 knots, and amount an armament twice as strong as the *Tiger*. She has two sisters.

That "le trident de Neptune est le sceptre due monde" is once more demonstrated by Riff events. It is the silent unrelaxing pressure of Admiral Hallier's blockading flotillas that is slowly but surely, and without scarcely any loss of life, bringing to his knees Abd-el-Krim, as he himself has recently publicly confessed. It is now clearly seen that if the gallant Spaniards failed so conspicuously in the past, and with such a sacrifice of blood and money, it was due not to lack of military ability or bravery, but to naval inefficiency and powerlessness. The time is near at hand when Spain, through French assistance, will be in effective possession of her rightful share of the Moroccan Empire.

The achievements of British, Spanish and Italian aviators, without mentioning those of French officers, point to the dawn of a new era in Colonial defense. No doubt sea power will still play first fiddle, but not to the same extent as formerly. Surprises will ever be in store from the air that will undo work already done by ships and by armies. British exploits in Mesopotamia show it. Flights across the Sahara desert (where air stations have been created), by Lieutenants Tulasne and Gama and by other brave officers, are paving the way for organized military air routes from France to all parts of her vast African Empire. Obsolete already are data from the Great War in regards to colonial defense. Under the new conditions Germany would not lose her colonies in the way she did. To a certain extent, air power offers means of remedying the defenseless condition of distant colonies. We are in for speed and time contests.

The newest Farman "avon de bombardement" of the super-Goliath class has passed through governmental tests with the usual success. She is reckoned to be the most powerful and serviceable bomber in actual commission, and will have plenty of sisters. It is officially called *F.-140 B.N.-4* (night bomber). Robustness, simplicity, and reliability have been attained in this giant biplane of 35 métres span, weighing over seven tons when empty and nearly twelve tons at service load. It can carry a fighting crew of six, enough oil for a 10-hour flight at 100 miles per hour (Paris to Berlin and back), and four tons of bombs. It is fitted with four Farman motors of 2,000 h.p. altogether.

Recent naval exercises on the Brittany coast have been interesting, though they had little to do with the realities of war. Admiral Chauvin, after dividing his small force into two mobile groups operating under cover of smoke screens, proceeded to give Lorient defenders the illusion that the Brittany arsenal was being attacked and surrounded on all sides by superior forces. A series of quick, clever feints over a wide sector put the gallant defenders out of their wits, exhausted them, and caused them to yell "it was not the game!" and, at the selected moment, sly M. Chauvin landed where least expected and without scarcely any opposition. Artificial cloud tactics are being skilfully practised in the French Navy. In the opinion of our experienced Admiralty such tactics open undreamt-of possibilities and may enable David to slay Goliath.

In the Mediterranean, under the supervision of the hard-working Admiral Violette, a fierce battle raged around Corsica under something like realistic conditions, the aerial factor playing an active and prominent part in cooperation with coastal defensive organizations. The strategic importance of Corsica is being increased as a consequence of the momentous rise of Italian sea power and also of the advent of long-range aerial weapons. Corsica is a sentry watching over the safety both of the Toulon arsenal and of the Toulon-Bizerta route. Corsica and Bizerta make up the chief assets of French offensive in the Middle Sea, and on their ready

efficiency rests the safety of France's fine African Empire. French power in the Mediterranean is measured, not by the meagre and undermanned Violette Squadron, but by the ensemble of the points d'appui and effective torpedo and aerial bases dotted over the western part. Admiral Dumesnil, a war-tried chief, is acting as general inspector with a view to giving its full striking value to that comprehensive organization.

French Personnel Situation

The Naval and Military Record, 10 March, 1926.—The commissioning of the thirty-odd units undergoing trials is being delayed for lack of crews and officers. The naval personnel exceeds 50,000, whereas the efficient Italian Navy, numerically equal to the French, only requires 30,000 officers and men, which speaks of superior military utilization. In the Marine Francaise, under the guidance of good-intentioned politicians, devoid of the military instinct, the administrative, red tape, scribbling branch of the service has grown enormously, absorbing a place ridiculously out of proportion to its weight in the balance of efficiency. The Rue Royale Admiralty spends in paperasserie making, in perfunctory agitation and make-believe, and routine formalities an incredible amount of talent, time, and money. So much so that many young officiers de vaisseau are rusting in shore unmilitary duties, whose right place ought to be at sea. Long-rooted habits are not easy to get rid of, especially when stability and authority at the head are none too plentiful. Gallant admirals, and not a few, have ascended the steps of the Admiralty house with the firm intention to put things in order, to make bureaucratic interest and pursuits subservient to the keen and direct preparation for war that alone counts. But they tried in vain.

The result is that the French Navy, while having personnel enough on paper and in worthless old lame ducks, is short of officers and crews for her newest and best units—that is for those craft on which rests in reality the all in all of French seapower—since everybody knows the greater part of the "flotilles et escadres" in commission possesses little more than nominal value for the purposes of modern warfare. Two years since Minister Dumesnil, who was splendid with his tongue, said that thirty per cent of the fleet personnel was on shore, but, happily, he was there and seamen would be sent to sea on war training, which is their raison d'être. Unfortunately, M. Dumesnil joined, after a few months, the phalanx of ex-ministers, and things have not mended since. The commanders of the new cruisers and destroyers, who are animated by the fighting spirit, bitterly complain of lacking the elements of efficiency. Gunnery and torpedo officers are sometimes wanting; and good organization and work are being rendered impossible by continuous changes, partly due to absurd recruiting laws. Admirals commanding at sea are handicapped by similar deficiences.

To this intolerable situation, which the Conseil Superieur is examining, there are three main remedies—a merciless pruning of the naval tree, ridding it of parasitical non-military growth; a reform of the present recruiting system, that is so beautifully democratic as to be incompatible with sea power; and, lastly, the wholesale condemnation of all pre-war units with the exception of six 24,000-ton cuirassés, of the croiseurs-cuirassés *Guinet* and *Rousseau*, and of the best flotilla units. Pre-war battleships and cruisers absorb too much personnel and money for their worth, as is shown by the 18,000-ton *Diderots*, that are ever being modernized and patched up. Against the latter proposal is the fact that the German Navy is gradually being renovated, and that it would not do for France to be deprived of her seagoing shield in the Channel. Officers of the younger school contend that aerial flotillas in adequate numbers provide the most reliable and economical solution to the problem of coast defense, and ought to be substituted for the costly make-believe "escadres et divisions de defense

côtière." Unfortunately, the French seaplane fleet exists mostly on paper; gross lack of competence at the head is paralyzing progress; and 200 million francs, earmarked for aviation, were left unusued within the last two years.

French Naval Aims

By Gustave de Kerguezec, *Foreign Affairs*, April, 1926.—As Chairman of the Naval Committee of the French Senate I am highly gratified at this opportunity to submit to impartial American judgment the naval situation, past and future, of my country, and to emphasize the fact that French naval policy, as far removed from imperialism as is Greenland from Cape Horn, holds exclusively in view the protection of French liberties and the cooperation of all peoples for world peace.

To be sure, one might compile from French newspapers a list of articles inspired by the rankest imperialism. What nation is without its chauvinists and super-patriots? France is a country of free discussion with a free press. But one swallow, as we say, does not make a spring. Though Commander Castex is a naval officer he does not speak for the French Navy and much less for the French nation.

Foreigners who visit France usually confine themselves to Paris, a city without restraints, without surveillance, where people flock from all parts of the world to indulge in gaieties which the French themselves could not afford even if they had a taste for them. Most often the tourist goes away without perceiving that he has learned nothing whatever about the real France, the France which in the industrious seclusion of her towns and villages is jealously guarding her national traditions, her national virtues, her national idea—everything, in short, which her past has achieved and on which her future will depend.

To understand the real feelings of the French people one must take into account the last fifty years of our history. The Republic which was set up on the fall of Napoleon III was an expression of popular enthusiasm, and it encountered serious difficulties in establishing its authority on more solid foundations. But once the French peasants had grasped its full significance, in terms of hope, of peace, of liberty, of justice, they gave the Republic an unshakeable stability.

At once the French Republic began covering its territory with a multitude of schools in which citizens of all classes were taught that France was greater and more glorious through the achievements of her thinkers than through the prowess of her generals, and that, as an heir of the French Revolution, she had a sublime mission in the world—the mission of peace and human brotherhood. The Republic, moreover, was successful in imparting this lesson. One may say with literal truth that all the plain people of France were reared in that conviction as in a religious faith.

The Great War came with all its trials and sufferings. During the five years it lasted, and during the five following years, the French masses lost touch with public affairs. Then came the elections of May, 1924, which placed M. Herriot in power and once more revealed to the family of nations the true features of France. Henceforth cabinets may rise and fall according to the vicissitudes of political life—as varied and changeable as the surface of a troubled sea. One can never predict what developments the morrow will bring. But on one thing the prophet may rely without fear of going wrong: that no government, whatever its complexion, can enlist the support of enough French citizens to follow a policy of foreign conquest. France used to live in dread of war. Those Frenchmen who have endured the last conflict have come to hate the very idea of war. Our country has only one ambition—that her frontiers be secure from invasion, that the provinces she has repurchased with some of her finest blood be safe from new attack.

Until her frontiers have been fully and permanently guaranteed, France must undoubtedly remain in a position to marshal her resources from overseas; and for that purpose she must be sure of unimpeded transit for her convoys. In a word, her naval policy may be reduced to a formula: "Protection of frontiers by land and sea, and security of communications."

I hope these prefatory remarks have made it reasonably clear that France must be far from satisfied with the present outlook.

Analysis of French Naval Strength in 1926

So much for a comparison of the French navy with those of other powers. If now we examine the French fleet in itself, we find the following situation:

Battleships

3 of the *Bretagne* class:

designed in 1913; armament, ten 13.6-inch guns, and eighteen 5.5-inch guns, delivering a broadside of 12,570 pounds. (The American *Colorados* carry eight 16-inch guns of much longer range, with a broadside of 17,700 pounds).

3 of the *Jean Bart* class:

designed in 1911; armament, ten 12-inch guns, and twenty-two 5.5-inch guns, broadside: 10,000 pounds.

3 of the *Diderot* class:

these we mention only to keep the figures complete; for they carry only four 12-inch guns and twelve 9.8-inch guns, with a broadside of 6,600 pounds.

Not one of these nine battleships can carry a torpedo. They may be considered worthless as compared with any of the capital ships of the United States, England or Japan. They are somewhat closer to the Italian battleships, four of which carry thirteen 13-inch guns, with a broadside of 12,800 pounds, while another has twelve 12-inch guns delivering a broadside of 11,700 pounds.

Light Cruisers

4 ex-German ships:

the *Metz*, the *Strasbourg*, and the *Mulhouse*, carrying six and seven 6-inch guns, and the *Thionville*, carrying nine 4-inch guns. All superannuated, except the *Metz*, which was launched in 1915. Armaments of old type, low speed.

Destroyers

1 ex-German ship:

The *Admiral Sénes*, carrying four 6-inch guns.

Torpedo Boats

41 old fashioned craft, much the worse from wear during the war:

of these 13 are French, antedating the war. 9 are ex-Germans; 12, ex-Japanese, dating from 1917 (tonnage too light, 700 tons); 3 French, built since 1914, but of doubtful value; 4 ex-Argentines, slow.

Submarines

39 boats, of which twelve, at the most, are serviceable.

8 are ex-German, of hasty construction. 31 are French, but built on designs prior to 1914. All are outclassed by the similar craft in other navies.

We must take account, however, of the ships at present building in French yards, and to which reference was made in the tables given above:

Ships Authorized by the Bill of April 18, 1922

3 cruisers, of 8000 tons, carrying eight 6-inch guns.
These units are without real value. They were hastily designed and their armament is already outclassed by cruisers of the *Washington* type (U. S. Navy).
6 destroyers, 2,400 tons, with five 5-inch guns.
12 torpedo-boats 1,500 tons, with four 5-inch guns.
6 submarines, 1,150 tons.
6 submarines, 600 tons.
1 airplane-carrier, 22,000 tons.
[An experimental craft, rebuilt from the battleship *Bearn*].

Ships Authorized by the Bill of April 12, 1924

2 cruisers, of the *Washington* type, 10,000 tons, carrying eight 8-inch guns.
6 torpedo-boats, 1,500 tons, like those mentioned above.
2 submarines, 1,500 tons.

Ships Authorized by the Bill of July 13, 1925

1 cruiser, *Washington* type, 10,000 tons.
3 destroyers, 2,400 tons, like those above.
4 torpedo-boats.
7 submarines, like those authorized April 12, 1924.
2 mine-laying subarines, 750 tons.

What can we say when we compare the ninety-four old-fashioned and superannuated units of our fleet with the 364 vessels of the Biritish Navy, equipped with all the improvements suggested by experience during the recent war in every branch of technical science?

THE MEDITERRANEAN SITUATION

But supposing we pass over the general world situation and confine ourselves specifically to the Mediterranean. How are we placed there?

Distribution of Naval Forces in the Mediterranean

	Great Britain	*Italy*	*France*
Battleships	8, modern, with 13.6-inch and 15-inch guns	5, useless	4, useless
Airplane Carriers	1, the *Eagle* 26,000 tons, 24 knots	none	none
Scout Cruisers and Destroyers	9, up-to-date	10, old	2, old
Torpedo-boats	36, up-to-date	32 up-to-date	13, serviceable, but old.
Submarines	6, up-to-date	41, up-to-date	24, serviceable
Totals	60, up-to-date	88, of which 73 are up-to-date	43, of which only a dozen of fighting efficiency

Let us assume that in case of an attack upon France, England remains neutral. The forty-three French units, listed above, would be confronted by eighty-eight Italian vessels of more recent design and of better armaments, not to mention twenty-two Spanish ships, also of recent build (2 battle-

ships, 4 cruisers, 6 destroyers, and 10 submarines). Furthermore, France would also have to face in the north a German Navy which, though much reduced, is still far from being a negligible quantity: thirty-six units, which Germany will be sure to improve as opportunity offers.

In any event, there can be no doubt that if, for one reason or another, Italy should see fit to oppose the movement of French convoys to and from Algeria and Tunis, not a regiment of troops, not a cargo of supplies, would ever reach France. If our four battleships more or less balance the five Italian battleships, what could our two old-fashioned, ex-German cruisers do against the ten Italians? How would our thirteen pre-war torpedo boats fare with the thirty-two new torpedo boats and destroyers they would be called upon to meet? How could we defend ourselves against Italy's forty-one submarines, all built since 1914, without counting her flotillas of small torpedo boats and scouts, for which we have no equivalent in the French Navy? How, especially, could our old and out-worn vessels enter battle on anything approaching even terms if, as was said above, France did not build a ship between 1914 and 1922, while Italy, for her part, was making the great effort in naval construction to which her fleets now owe six light cruisers, twenty-two torpedo boats, and forty submarines (to which nothing in the French navy corresponds)?

Naval Policy

All of this, we imagine, shows how foreign to warlike intent must be the naval policy of France at present. The writer has defined that policy many times in speeches before the French Chamber and the French Senate. France will not consider foreign conquests under any conditions, upon any pretexts. She is interested only in security toward the East. Facing as she does in that direction a population which outnumbers hers by more than a third, she needs a decisive supplement of colonial troops. And this situation begets a naval policy providing, first, for the protection of her coasts; and, second, for the safe transport of men and supplies to an extent necessary for the preservation of her territorial integrity. These objectives have been made concrete in a formula: *the abandonment of fleets for offensive purposes* (that is to say, of heavy ships capable of fighting overseas); *and the maintenance of defensive fleets for the protection of our coasts and our convoys.*

We are well aware that England is constantly urging us not to worry about the defense of our coasts nor about the provisioning of our armies—she will attend to that, in case of conflict. An extremely attractive offer! But need we repeat our objection to it? To accept it would be to place France under the complete domination of England, to surrender all autonomy in our diplomacy, to make the French Army an instrument of British continental policy, to reduce France, in short, to a position of vassalage toward England. Is there a people on earth that could accept such a humiliating and insecure position?

France insists on retaining freedom to determine her own destinies; that is to say, to follow her own diplomacy, which is a diplomacy of peace and brotherhood between the nations. No people welcomed the idea of general disarmament more enthusiastically than the French. There is not a home in all France where that idea is not deeply loved. All our mothers who have lost sons on our battlefields, all our widows, all our orphans, find in that idea a consoling faith that their dead shall not all have died in vain.

The French have suffered many disappointments. Henceforth they prefer to see where they are going. They regarded the Washington Conference as the event of the century, because they thought it was to end in general disarmament. They were profoundly hurt on discovering that disarmament was to apply only to certain nations, and on being forced to realize that, as far as the Old World was concerned, the conference had resulted only in placing Europe under the tutelage of England.

The reader need only be reminded of the conditions under which we were admitted to that conference. No precise understanding had been made, no program clearly outlined. As Mr. Hughes had said (see the French *Yellow Book*), we were to talk things over and come to an agreement as among friends. Nothing could have been more to our liking. As a matter of fact, an arrangement, in which we were not considered, had already been worked out before our arrival; and we found, not the atmosphere of straightforward and peace-seeking discussion which we had hoped to find, but conflicts and adjustments of special interests.

From November 12 to December 15—for more than a month, that is—our delegation was held aloof from the negotiations in progress between the representatives of the United States, Great Britain, and Japan. Then we were informed, with no opportunity for discussion, of arrangements which gave a character of permanence to the deterioration of our navy, brought upon us by four years of war, during which we had sacrificed the maintenance of our naval establishment to the common objectives of our allies on land.

We realize that mistakes were made in Washington by the French delegation. Its technical advisor was a general officer who had evinced pronounced imperialistic views during the war and who had been, in consequence, relieved of his post as Chief of the General Staff. The same gentleman advertised his scorn for the will of Parliament and came home demanding 350,000 tons in battleships at a time when Parliament had expressly voted that it wanted none at all.

However, the writer's intervention, through a speech in the Senate on December 26 and 27, 1921, attempted to put matters right again. In that speech the writer defined his attitude toward purely defensive instruments of warfare, affirming an intent to use them only against war vessels, and specifying that France would never employ her submarines in ways which had been so justly condemned in the case of the Germans.

The submarine, said the writer at that time, is the only weapon left to a poor or to an impoverished country. If small nations and ruined nations are denied any weapon of defense against heavy battle fleets, what becomes of the liberty of nations? How is it more cruel for a submarine to sink a battleship which is attacking a coast, than it is for the battleship to bombard shores inhabited by women, children, invalids, and noncombatants? To ask the question is to answer it. On the other hand, let the surface killers disappear, and the weak will be at once in duty bound to suppress their submarine defense.

Subsequent facts have borne out this contention. For the small powers may now be seen basing the protection of their coasts on submarines, which are constantly increasing in number. The small navies had thirty-one submarines in 1914. They now have ninety—Holland alone twenty-four. One can hardly accuse nations such as Holland, Sweden, Denmark, and Norway of imperialistic notions.

The Attitude of the French Parliament

However, we may leave the discussion to an official document, which defines in the clearest possible terms the writer's attitude toward French naval policy. Debated and unanimously adopted by the Senate Navy Committee, it was read to the Senate on April 3, 1925, and received the unanimous applause of that assembly. It accurately expresses the sentiments of the French Parliament, and of the French Nation, on this question of our navy:

"As early as 1916, while the war was still in progress, we outlined before the Chamber of Deputies the naval policy that France would probably be called upon to follow. We expressed the conviction that France should abandon fleets of heavy ships for offensive overseas, and confine herself

to defensive fleets, designed to protect her coasts, her colonies, and her lines of communication.

"Later on, in 1919, as spokesman for the Committee on Naval Appropriations before the Chamber of Deputies, we embodied those views in an official report which was approved not only by the Committee on Finance, but by the Chamber itself.

"We took the initiative also in bringing about the suspension of work on the battleships of the *Flandre* class, the most modern then under construction in our yards.

"Three years ago the Senate likewise went on record in favor of these views, solemnly declaring that the Parliament, sole spokesman for the country, would not vote credits for fleets of offense, since the policy of our country was a defensive policy, and that the watchword of French naval policy should be 'The Freedom of the Seas.'

"England, on the contrary, during this time continued building not only submarines, but heavy ships as well, launching them with such rapidity that the naval review off Spithead offered to the world a spectacle of the most formidable armada ever assembled in the history of mankind.

"During the Washington Conference the strength of our navy in capital ships was so fixed and limited that no circumstance could arise whereby we should become a menace to British power. We saw no difficulty in such limitation, provided no impediments were offered to our means of defense. To omit such a proviso would be tantamount to recognizing English hegemony over the continent of Europe and our own political vassalage. No Frenchman could think of accepting such a situation.

"Our country would like, in case of war in Europe, to be in a position to defend its independence and safeguard its lines of communication.

"England, on the contrary, would like to be mistress of all the seas about us and thus control, and perhaps determine, all European policy. England's intent was well defined in a speech delivered by Lord Rosedale before the House of Lords on the first of April last. Said Lord Rosedale: 'I should like to inquire as to what rights exactly are reserved by Great Britain for the future use of her naval power. I believe that the only way to establish a durable peace in Europe is to leave England an overwhelming superiority, and to state clearly to other nations the principles which we intend to uphold on the sea in the event of war.'

"Two doctrines therefore confront each other,—the English doctrine of 'British Supremacy,' and the French doctrine of 'Freedom of the Seas.'

"The French Parliament will glady allow the government to participate in a new Conference on Disarmament, provided disarmament be for all alike—even total and complete; and, in any case, provided disarmament be not designed to entrust the freedom of small nations to the will of those which harbor dreams of world empire.

"Washington? Yes! . . . . But a real Washington, where we shall know in advance what problems are to be raised, what points are to be discussed, what proposals are to be made.

"The French Republic, perennial champion of Liberty, would probably incline toward a formula of complete disarmament which would guarantee security to the weak and freedom to all through the constitution of an international police force which would not be an instrument of domination in the hands of any power.

"In any event, it would be on the basis of the freedom of the seas and equal freedom for all, that the Parliament could approve of participation by the government in a new conference, in which it would be happy to see the source of greater security, greater freedom, more perfect justice."

Were these not the views expressed at Geneva a year ago by M. Herriot, and more recently at Locarno by M. Briand? Were they not the views of President Wilson himself when he formulated his Fourteen Points?

In concluding this article we can only repeat that France is in favor of complete and total disarmament; that France is in favor of placing the naval police power in the hands of a group of nations which will assure the freedom of the seas; that France will favor the adoption of any formula which will prevent any nation in the world from gaining hegemony over any continent and supremacy over any sea. France aims at peace with the whole world—with her enemies of yesterday, as well as with their former allies.

GERMANY

Germans Campaign for Great New Navy

By Hector C. Bywater, *The Baltimore Sun*, 13 March, 1926.—A few months back I drew attention to the active naval propaganda that was going on in Germany, and sketched the progress which had been achieved in rebuilding the fleet. Since then there have been further interesting developments.

That the demand for a navy worthy of Germany's status as a great maritime power is no longer confined to Nationalist circles is proved by the celerity with which the Reichstag recently passed the largest naval budget introduced since the war. Whether or no the nation as a while really desires a big fleet, it is certainly significant that the Liberal press should remain silent while the government appropriates nearly $51,000,000 for naval armaments in 1926.

Thanks to seven years of a well-organized publicity campaign, initiated and controlled by the Defense Ministry, the legend that Germany owed her downfall to internal treachery, and in no wise to the failure of her armed forces, has come to be widely accepted as historic truth.

Even their admirers have to admit that the German people are extraordinarily amenable to mass suggestion. Had anyone claimed in 1919 that the German Army and Navy had emerged from the war without suffering a single reverse, even the simplest Teuton would have smiled indulgently. Today, however, that fantastic claim is accepted in good faith by millions of intelligent Germans.

All the misfortunes that overtook the Fatherland in the war period, culminating in ruinous defeat, are attributed to the underground intrigues of the Socialists. This consoling thesis has become a national tradition. Far-reaching plans for the creation of a powerful and well-balanced navy have been prepared, but they cannot be implemented while the Versailles Treaty stands. Consequently, the revision of the "'Versailler diktat," or at least of its military clauses, is one of the first objectives of the patriotic group.

The case for a strong fleet is presented forcefully yet temperately by Admiral Meurer in the February number of the *Marine Rundschau*, a naval review published from the Ministry of Defense in Berlin. The establishment which Germany is at present permitted to maintain is too weak even to protect her seaboard and her coastal trade, says the writer. He says:

"The annihilating terms of the treaty make it impossible for us to rebuild our navy. Not only have all our battleships been taken away, leaving us with a puny collection of obsolete ships which are totally inadequate for the defense of our world-wide sea interests and our home waters; not only are we forbidden to possess such indispensable weapons of modern naval warfare as submarines, seaplanes and aircraft-carriers, but we are ordered to keep such new ships as we build within narrow limits of size that renders them far inferior to foreign vessels designed under the Washington rules."

The Versailles Treaty, it may be recalled, restricts Germany's future "battleships" to 10,000 tons and her cruisers to 6,000 tons, as compared with

the limit of 35,000 and 10,000 tons, respectively, imposed by the Washington pact.

The only asset of value that remains to the German Navy is its war experience, declares the Admiral; and even this cannot be turned to advantage while the above restrictions are in force. Asserting that the first German statesman who demands the removal of these humiliating fetters must be able to count on the solid support of the nation, he urges that the smoldering fires of naval enthusiasm be fanned by propaganda into fierce flame.

Under present conditions Germany's vast marine interests are virtually without protection. In 1914, when her foreign trade was valued at twenty-one milliards of marks, of which 67 per cent was sea borne, she had the second largest navy in the world. In 1925-26, with foreign trade worth sixteen milliards, 68.6 per cent being sea borne, she does not possess one efficient battleship. Her mercantile marine of 1914 totaled 5,200,000 tons; now, in spite of enormous war and post-war losses, it has been brought up to 3,100,000 tons and is still growing rapidly.

In short, were naval power dimensioned by the extent of shipping and overseas trade Germany would already be entitled to a fleet of the first magnitude.

These are undoubtedly arguments of great weight, which it is difficult to refute. That Germany, on entering the League of Nations, will lose no time in raising the question of her naval status and demanding some modification of the Versailles restrictions, is all but certain.

It will be an embarrassing problem for the Entente powers, and especially for Great Britain, who was no doubt responsible for the drastic naval clauses of the peace treaty. Germany might be satisfied with concessions in regard to the tonnage of her future battleships and so forth, but it is on the cards that she will claim the right to build submarines and long-range naval aircraft. How Britain would meet that claim can only be surmised.

Anxious as the British people are to live on friendly terms with their late enemies, they could hardly be expected to look on with equanimity while Germany busied herself with the construction of U-boats. The submarine question may yet prove a serious snag in the course of Anglo-German relations.

Germany meantime is building new fighting craft with great energy. Following the completion of the cruiser *Emden* last fall a new cruiser was laid down at Wilhelmshaven, and a third and fourth are to be begun this year. All four vessels are of a fairly powerful type, displacing 6,000 tons, with a speed of twenty-nine to thirty knots and a battery of eight 6-inch guns. Six destroyers of 800 tons, very vast and heavily armed, are in hand at Wilhelmshaven, and six more are to be started during the current year. An experimental small torpedo boat, probably driven by oil engines, is to be laid down.

The 1926 budget contains a substantial appropriation for new guns, torpedoes, and other munitions. Special attention is being paid to the development of torpedoes and mines, weapons in the use of which the German Navy has always excelled. The whole of the active fleet is being equipped with fire-control and radio equipment of the latest design. In spite of the handicap of obsolete material no effort is spared to maintain a high standard of efficiency in naval gunnery. This year the old battleship *Zaehringen* has been fitted out as a target ship, under radio control, and will be employed in this capacity during the firing tests to be held in the spring and fall.

If money talks, the fact that Germany is now spending $46,500,000 on new warships, apart from the normal expenses of the naval establishment, speaks volumes for her determination to reënter the community of major naval powers. Unless all the signs are misleading, the League of Nations

will soon be faced with a pretty problem, and a recent photograph of Admiral von Tirpitz, wearing a broad smile, may prove to be prophetic.

JAPAN

Japan's New Cruiser Believed Exceptionally Powerful Ship

By Hector C. Bywater, *Baltimore Sun*, 4 April, 1926.—Reliable details of the new Japanese cruiser *Furutaka*, launched in February, 1925, and just put into service, show her to be a truly remarkable vessel.

Japan's naval designers have been working for some years past on original lines which diverge at many points from current practice in Europe, and the *Furutaka* furnishes a striking example of their ingenuity.

She is 7,100 tons, engined for a speed of 33 knots. It has long been known that she would carry the imposing battery of six 8-inch high-power guns, which were assumed to be mounted in double turrets, two forward and one aft. It transpires, however, that a different system has been adopted.

The guns are mounted singly in armored turrets, disposed in two groups on the foredeck and afterdeck, respectively, the middle turret of each group being elevated above the others. This enables all six guns to be discharged on either broadside, but only two guns can be aimed dead ahead or dead astern, though a third could be brought to bear on the target if the ship yawed a couple of points.

To compensate for this weakness in axial fire there are two important advantages. The first is that guns mounted singly can maintain a higher rate of fire than guns on twin mounts, so that the volume of discharge in a given period from the *Furutaka's* six weapons would probably be equal to that from eight guns mounted in double turrets.

The second advantage lies in the multiplication of gun positions. To silence a conventional "treaty" cruiser carrying her eight guns on twin mounts it would only be necessary to register a direct hit on each of the four turrets, since the thin armor which protects these positions would not keep out an 8-inch or even a 6-inch shell. In the *Furutaka*, however, there are six separate gun positions to be put out of action before the ship is silenced.

The tactical features of this vessel have evidently been thought out with the utmost care. Her appearance is decidedly bizarre, with three turrets arranged pyramid-fashion near the bows, three more turrets similarly disposed near the stern and four funnels paired in casings so that it looks as though there were only two. But appearance is a minor consideration in naval design, and judging from these authentic details the *Furutaka* is an exceptionally powerful and efficient ship for her tonnage.

There are three other units of the class, and of these the *Kako* is ready for trials, while the *Kinugasa* and *Aoba* have been launched. Additional to the six 8-inch 50-caliber guns, which fire 250-pound shells at a rate of five per minute, each vessel has a battery of anti-aircraft guns and twelve torpedo tubes.

So far as fighting value is indicated by the design, the American *Omaha* of 7,500 tons and the British "E" ships of 7,600 tons make a poor showing compared with this 7,100-ton Japanese type. It is true that warships which look impressive on paper sometimes prove disappointing in service, but Japanese constructors now enjoy a high reputation which it is improbable that their latest cruisers will belie.

New Japanese Cruiser Discussed by Captain Knox

By Captain Dudley W. Knox, *U. S. N., Retired. Baltimore Sun*, April 1926.—Recent information from British sources indicates that the new Japanese cruiser *Furutaka*, characteristics of which have been heretofore withheld, possesses considerably greater gun power than either the American *Omaha*

class or the British *Emerald* class, of approximately the same size. The advent of the completed *Furutaka* again emphasizes the energy with which the Japanese have been building cruisers since the Washington Conference on limitation of naval armaments, and the need of extending the provisions of the limitation agreements so as to include cruiser tonnage.

It is somewhat of a surprise to learn of guns so large as eight inches in caliber being carried on a vessel so small as the *Furutaka,* rated at 7,100 tons. This tonnage probably refers to the displacement of the vessel when in a light condition, with a minimum of fuel on board to run speed trials. If fully loaded with fuel the Japanese cruiser may easily equal in size the British *Emerald* (7,600 tons) and the American *Omaha,* (7,500 tons). The two latter, however, carry only 6-inch guns in their main battery—a normal size for the date of their design, some six years ago.

But the power of the *Furutaka* lies not alone in the size and range of her guns but also in the novelty of their arrangement. Placed all on the center line of the deck each gun may fire on either broadside, so that normally the entire battery may be brought to bear. If she were opposed to the British *Emerald,* for example, she would be able to use six 8-inch guns against the *Emerald's* six 6-inch guns. In the case of our *Omaha* the *Furutaka* would be opposed by eight 6-inch guns, out of a total of twelve such guns which the *Omaha* carries.

It must be assumed that some sacrifices in other characteristics have been made in the *Furutaka* design to gain this advantage in weight of broadside gun-fire. The center line arrangement of her guns, for example, restricts her to the use of only two guns, when firing ahead or astern, as compared with the *Omaha's* six guns, and the *Emerald's* four guns, in like circumstances. The necessarily greater proportionate weight of guns and ammunition in the *Furutaka* design probably accounts for her having a knot less speed than the *Omaha,* and is likely to mean poorer armor protection or less fuel capacity and radius of action.

The problems of the naval designer revolve about the question of weights. Speed, gun-power, armor protection, and cruising radius, all cry for weight, which if given to one must be taken from another.

There is no question, however, of the center line arrangement of guns being economical of weight, and the new Japanese design is likely to be generally followed in future cruisers, just as center line mounting has become standard for battleship design. The sacrifice in bow and stern fire may be overcome by mounting guns in pairs, or even groups of three, and elevating the mounting of some groups to fire over the others.

The feature of placing guns on different levels is reported to have been incorporated in the Japanese design, but each gun is mounted singly. Thus only two guns can fire dead ahead or dead astern. Had four guns been paired, stronger bow and stern fire would have been obtained without any sacrifice of broadside fire.

A survey of the cruiser situation today, four years after the Washington Conference, discloses how unfortunate it is that Mr. Hughes' original proposal to limit cruiser damage was not adopted by the conferring powers. A few days ago the United States let a contract for the first two cruisers to be laid down since the conference adjourned. The Naval bill just passed appropriates for three more, contracts for which cannot be completed for several months.

We thus have five cruisers on paper, and none others, which can be counted as modern, since the treaty limitation of size and gun-power for cruisers has caused all new designs to approach these limits and thus render obsolete the much weaker cruiser types, which were standard before the conference.

Our score since the conference is then five "paper" cruisers. Compared with this the Japanese and British each have not only a number of "paper"

cruisers, as to which data are not at hand, but also each one of these nations has in addition actually under construction, or completed, twelve modern cruisers, begun since the conference. Thus we see how scrupulously America has lived up to the spirit of the conference which met to reduce the burdens of competitive armaments, and how ineffective has been this experiment towards restricting competitive building by example.

When it is remembered that a modern cruiser is as large and powerful and expensive as a battleship of a generation ago it is easily understood that until competition in cruisers is brought to the same status as in battleships, our so-called "limitation" of naval armaments is not limitation at all, and that is the fact today. Non-limitation still prevails in the number and aggregate tonnage of cruisers, destroyers, submarines mine-layers, and other auxiliaries. Limitation applies only in the case of the battleship and the aircraft carrier, and as ineffective in preventing a competition in naval armaments. The new competition in auxiliary tonnage including cruisers, already in full swing promises soon to be as expensive as the old, and to bring about differences in total sea power greatly at variance with the theoretical 5-5-3 ratio established by the naval treaty.

In the new competition Japan has been the pacemaker, not only in ships laid down but also in ships projected. Britain has not been a laggard. America is already far behind. It is this situation which calls for the greatest attention on the part of our delegates to a new conference, if held. In any new agreements they should not permit us to be penalized on account of having "played the game" by not laying down any new cruiser tonnage during the past four years.

On the basis of the status quo four years ago Secretary Hughes proposed a 5-5-3 ratio in cruisers and other auxiliaries, as well as in battleships. His proposal was publicly and formally agreed to "in principle" by the other delegations present, but in the final agreements only battleships, in which we then held the "edge," were limited. We have now scrapped our "edge" in battleships. Let us in justice to ourselves insist upon the basis of the Hughes proposals in any new agreements which may be made with respect to cruisers.

Failing new agreements America should build up to the other powers in cruiser strength. Without a due proportion of cruisers a fleet is badly unbalanced and its strength in other types cannot be brought in play effectively. Neither can the trade route be kept open to merchant commerce, upon which the activity of the fleet and the industrial life of the nation so much depends.

Training in the Japanese Infantry

The U. S. Infantry Journal, March, 1926.—The United States and Japan have recently entered into an agreement by which an exchange of officers has been made for the purpose of observing training methods. By the terms of the arrangement these officers are attached to regiments where they receive the privileges of officers of their grade for the duration of their attachment. Since 1903 the British and Japanese have had a somewhat similar arrangement by which "language officers" were exchanged. These officers, however, were connected in a way with the diplomatic staff and from time to time were attached to regiments and schools or detailed as observers at maneuvers.

The observations of the first American infantry officer are extremely interesting as they represent first hand informations gained through personal participation in the activities of the regiment to which he was attached. He reported for duty with the Imperial Japanese Army in June, 1925, and was attached to the Twenty-ninth Regiment. The Twenty-ninth Infantry is stationed at Wakamatsu, most favorable for infantry training. Japanese officers maintain that the training in regiments stationed in the

rural districts is more varied and thorough than the training given in the cities. At Wakamatsu, the terrain is ideal for varied tactical maneuvers, night marches, field firing with live ammunition, exercises in fording rivers, building bridges, bivouacking, billeting, trench construction, and other important training that the troops stationed in Tokyo and other cities cannot possibly receive.

Bayonet

Bayonet training is greatly stressed in the Japanese infantry, and as so much has been said and written in this country on the use of the bayonet, so many controversies formerly agitated the minds not only of the infantry tacticians themselves but of the ordnance experts as well, that it is interesting to look into the way this question is handled in Japan.

It will be remembered that our own bayonet training has gone through a process of evolution since the days of the old single-shot Springfield of Spanish War days. The old bayonet of '98, triangular in cross section, was a real thrusting weapon at any rate. The Krak, which followed, had our first short knife bayonet, an improvement in many respects over the Springfield bayonet at the expense of length.

Later we were told that the bayonet was obsolete and the new model 1903 rifle had only a useless ramrod bayonet. Temporarily, at least, the spirit of the bayonet was in abyeance. From this extreme, sentiment violently swung to the other in 1905, when a new, longer, double-edged knife bayonet, was adopted and, for the first time, the Infantryman had an admirable cutting and thrusting weapon. Although given the weapon, the "spirit of the bayonet" was still lacking and training in its use was for several years little more than a physical exercise, an adjunct of *Butt's Manual*.

The World War, as a result of trench fighting, saw the bayonet come most decidedly into its own. Real use of the weapon was brought to this country by the members of the various British training units which, installed at our numerous divisional cantonments, preached the bayonet both by word of mouth and by spectacular visual precept.

Today our infantry still features the bayonet training as one of the two or three most important subjects in the curriculum of the infantry recruit. The indispensable foot-soldier must be thoroughly trained to march, to shoot and to use his bayonet.

Turning now to our neighbor on the other side of the Pacific, let us see how the Japanese treat this all-important subject.

The Japanese infantryman is taught from the beginning that the bayonet is *the* weapon of the infantry, that with it and with it only can the enemy be made to give ground. He is constantly reminded that the ultimate decision is sought in the assault and that the bayonet is the ultimate factor in every assault. The following is a summary of the school of the bayonet as taught at present: "The spirit of the Japanese Army is the spirit of the offensive and the bayonet is essentially the weapon of the offensive. To be effective in its use a soldier must be confident, skilled, and without fear. He must have absolute confidence in his weapon and in himself. This confidence is only begot by constant training and practice and a nurturing of the spirit of the bayonet.

"The abdomen of the enemy is the first objective of the bayonet, and it is the place easiest hit and easiest pierced, with the exception of the throat. The thrust to the throat, however, is often hard to get home; the throat is the part of the enemy's body which he can most easily remove from the line of the bayonet thrust. The soldier will do well, therefore, to run at his foe at top speed, shouting his battle-cry in order to weaken the spirit of the enemy, and thrust home at the stomach with all his might and with the full strength of his weapon and his arm. Usually this first thrust will be successful. If not, a second thrust should be made from either side of the foe, and at once, as no time should be lost in fencing. The man who

thrusts the surest and the quickest, and thrusts repeatedly, is the man who wins in the bayonet fight. The cold steel has, from time immemorial, been the weapon of the Japanese soldier. With it, and with it alone, he has preserved our country and made his glorious record as a fighting man.

"No machine will ever be invented that can withstand the bayonet courageously and intelligently directed by the human brain and the human hand. Let others place their reliance chiefly in machines. They can never devise a war machine that will overcome the Japanese infantryman and his bayonet. Handle it as your fathers did their swords and rely on it as they relied on their swords. Machines and all the mechanical agencies of war may batter and torture the Japanese infantryman; they may churn the ground he is holding into quagmires of blood and frightfulness; they may shatter his advancing ranks; but eventually, as in all times, he will close with the enemy and the final issue will be met man to man. Then the bayonet will be supreme and the spirit of the bayonet will be the spirit of the winner.

"As in the offensive, so in the defense. The enemy must eventually dislodge us, or attempt to take ground by closing with us. His artillery, gas, air squadrons may prepare the way for his infantry, but he must seek the ultimate decision in the assault and his infantry will be opposed by our bayonets. We can no more rely on machine guns and other mechanical weapons in the defense than the enemy can rely on them, and them alone, in the assault. We must keep our ground with our bayonet when he attempts to take it with the bayonet. Even on the defensive the spirit of the bayonet will be the spirit of the offensive. We can not wait for the enemy to enter our trenches. We must oppose him before he reaches them. At the proper time the order will be given to meet the enemy in the open and meet his attack with an attack more fierce, more determined, more confident and more fearless.

"But the defensive will seldom be the rôle of the Japanese infantry. He has always kept in mind that it is only the offensive that wins and the spirit of the offensive will dominate the plans of the army and its operation, and be alive in the soul of the field marshal, and all the way down to the brave warrior in the ranks. The field marshal will count his bayonets and measure the strength of his forces by that count. All his other weapons he will use in protecting and assisting the man with the bayonet, but the latter will be his chief reliance, and on the latter will his plans be based. The enemy can not overthrow our plans until he has overthrown our infantry and their bayonets, and we can only overthrow the enemy by the fearless use of these same bayonets. The machine gunner, the engineer, the transport corps soldier and all others, in close cooperation with the bayonet man, will do all in their power to help him forward, for on him and him alone, in the ultimate assault, depends the fortune of all. If he wins, the army wins; if he fails, all is lost. The most brilliant exploits of the artillery, cavalry, air service, and all other arms can not save the day if the man with the bayonet fails."

The foregoing is taken from the Japanese regulations verbatim. Eye witnesses of their infantry training report that bayonet training is continuous and most practical.

The long thrust is used to the exclusion of all other forms of attack, the butt of the rifle is seldom, if ever, used. If the first long thrust fails, the soldier at once drops his rifle and closes with his enemy, using his hands and feet. No time is lost in fencing. The men are taught that the abdomen first and the throat second are the only points to attack. The attack is made in pairs as far as possible.

A large part of the time instruction in bayonet training is devoted to personal combats; the winner of each combat must meet man after man until he is himself defeated, when he retires from the ring for practice with a skilled instructor.

Night maneuvers are always carried out with unsheathed bayonets in order to accustom the men to handling the rifle in the darkness under these circumstances.

The Japanese bayonet run used in training has several unique features. One is a trench about twelve feet deep and eight feet wide which must be crossed in the charge. One man bends over while his companion leaps upon his back and scrambles over the top with his rifle still held in his right hand. The sides of the trench have about a three degree slope revetted with wattling which assist in getting out of the trench to some degree.

Assaults are also made against a section of trench protected by a belt of barbed wire about fifty feet deep. The first few men to reach the wire (which is about three feet high) throw themselves over it. Their fellows jump on their backs and in turn throw themselves as far forward into the wire as possible and begin cutting it out from the bottom and worming themselves forward as they clean it out. In practice, smooth wire is used. The first man who throws himself on the wire lays his rifle over it in front of him, and the man who comes after him leaps from the back of the former onto the rifle, and from there on deeper into the wire. This method of advancing in the assault is very effective when the infantry can get no artillery preparation to clean out the wire and seems to obviate the necessity of pausing to cut through the first fifteen feet of wire.

The skilled bayonet man is looked up to with something akin to awe by his fellow soldiers. The expert is frequently excused from various onerous duties that must be performed.

The bayonet instructor is treated with special deference and respect by both the officers and enlisted men. In many cases he is a civilian, a professional bayonet and sword fencing master who is engaged by the regiment to polish off the rough spots in the technique of the bayonet class.

When the first and second reservists report for training great care is taken and much time spent in rekindling the spirit of the bayonet in the hearts of these old soldiers. The regimental commander personally hands each reservist his rifle with the bayonet fixed and admonishes him to guard it and keep it unsullied as he would his soul. He is reminded that the spirit of the bayonet never changes and that he must strive to regain the mastery of the bayonet that he won years ago by hard training and practice.

When the students of the high schools, normal schools, and colleges report for three weeks of military training with the regiment during the summer, particular emphasis is placed on bayonet training. At least one hour and a half each day is devoted to a series of personal combats, and at least another half hour is given to instruction on the bayonet run where the students practice bayonet assaults over broken ground and through barbed wire and other obstacles.

To say that the bayonet is venerated by the Japanese infantryman is certainly not putting it too strongly.

Musketry training is thorough and effective and is mainly for the benefit of the noncommissioned officers who, in the Japanese Army, apply the principles of collective rifle fire in battle. In collective rifle fire the team work is very good although the accuracy of the individual soldier decreases rapidly at ranges over three hundred yards. Range is estimated by the eye, by the observation of fire, and from maps. Tracer bullets and range finders apparently are not used. The noncommissioned officers are carefully trained and remarkably skillful in estimating ranges by eye and are thoroughly familiar with the conditions that affect the appearance of targets, such as light and terrain, background, depressions, darkness or fog, etc. The noncommissioned officers are very carefully trained in estimating distance by the observation of fire. In China, or in Manchuria particularly, where the ground is dry and usually dusty, this method of

range estimation would be very effective, as the strike of the shots would be easily observed. Range cards are used by the heavy machine gunners when with a unit in defense.

The Japanese soldier's ability to hit moving field targets is much greater than his ability to hit bull's-eyes, and the Japanese officers maintain that their training in musketry and rifle marksmanship aims at this ability and not at making the soldier a superfine shot on the target range. The rate of fire in combat is slow and would be about five shots per minute as long as the officers maintained fire control.

In Musketry training great use is made of surprise targets. Firing is usually by section. A section consists of two rifle squads and a light machine gun squad. There are six sections in a peace-strength company and probably the same number in a war-strength company.

Scouting and patrolling in the Japanese Army has been reduced to an exact science in which no detail is too minute to be overlooked or slighted either by instructors or pupils in practice or by scouts and patrols in time of war.

The Japanese soldier's small stature, agility, and keeness of eye are factors tending to make him efficient in scouting and patrolling and furthermore the work seems to hold a certain fascination for him. Individual scouts receive very careful training in their duties and the most intelligent men in the company are selected for this important and dangerous work. The utmost care is taken to camouflage and conceal the scout and he is usually an expert in the use of cover. This phase of the Japanese soldier's training is quite enlightening since there has been an impression that the Japanese were poorly trained in this work. In only one important phase of their duty are Japanese scouts deficient and that is in sketching. Not one in ten can make the simplest sort of sketch. Many of them cannot even read a map scale or determine visibility from the map. This would seem to indicate that they are inefficient, but such is not the case. When it comes to moving unobserved over ground affording scanty cover, to observing enemy movements, to calculating enemy strength, enemy position, what arms of the service the enemy forces consist of, the rate of march of enemy columns and the wheeled vehicles accompanying the enemy the Japanese scout is second to none. He may not know what an azimuth is but if his methods are not as scientific as ours in some respects, at least the results he achieves are remarkable. His powers of observation seem to be highly developed. As observers and imitators the Japanese as a race are in a class by themselves. Keen powers of observation are the rule among Japanese soldiers and the scouts' special training in systematic observation develops this natural faculty to the highest degree.

Scouts always reconnoiter to the front and flanks of assaulting platoons but do not appear to be used when a platoon is ordered to flank a hostile point of resistance. The Japanese maintain that use of scouts in this operation is more likely to betray the movement to the enemy and that rather than lose the advantage of the element of surprise they would rather move forward unprotected by scout reconnaissance.

Scouts of the reserve units are especially trained and instructed to send back information at once that would seem to indicate movement on the part of the enemy, such as preparations for counterattack. They also must immediately report when the assault units are held up or driven back or when any break in the assaulting line occurs whether through losses or delay in the advance of certain of the units in the assault.

All scouts carry a green camouflage net which they fill with grass, branches of trees and bushes and with this thrown over their heads they are effectually concealed from observation from all directions. It is the most

efficient camouflage that could be devised for scouting in wooded or grasy country. With the aid of this net the scouts often approach to within thirty yards of hostile lookouts without being observed if there is any grass or scrub cover available.

The training in patrolling is excellent. Teamwork between members of a patrol is very good. Patrols generally move out in single file or as a line of skirmishers. The diamond formation in patrolling is apparently not used, or do any patrols divide into two parallel columns of files at any time. Patrol formations are usually quite compact when traveling through woods or villages. The patrol leader is always the point and the "getaway man" is always the rear. Combat patrols designate no "getaway man."

The Japanese have a fondness for assigning officers to lead patrols. The commander of any point of any detachment of any size whatsoever is always a commissioned officer and fully one half of the combat patrols and at least one third of the reconnaissance patrols are led by commissioned officer.

The Japanese, for hundred of years, have had perfect foot freedom and they suffer greatly from foot troubles when compelled to wear leather boots and shoes. The Japanese infantryman's shoe is a clumsily made affair, very stiff, unyielding, and practically formless. Its greatest defect is a shallowness at the sides of the shoe in front which chafes the little toe and the toe next to it. It also seems to be very ill-fitting in the heel. Most of the foot trouble is due to abrasions of the heel and the smaller toes, and hardly a man finishes a long hike (e. g. 20 miles) without painful blisters. The men prepare themselves for a hike by inserting a pair or two of straw warsji (sandals) in their packs and when their feet become blistered they remove their shoes at the next halt and continue the march in the foot gear to which they and their fathers have been accustomed for centuries.

During the Russo-Japanese War and the Chino-Japanese War most of the soldiers discarded their clumsy boots for warsji and the same would take place if they went into action tomorrow.

The system of halts on a march is practically the same as ours: fifteen minutes rest after the first fifty minutes of hiking and a ten minute rest every hour thereafter. Cavalry trots seven minutes and walks five.

No attempt is made to keep the man in step at any time during a maneuver march and they are allowed to carry their pieces in any way they see fit. The pace is decided on before the march begins and it is not changed no matter how hard it may be to maintain it. Companies keep fairly well closed up and breaking ranks on any account is severely dealt with. The company commander usually marches in the rear of his unit during a march with one of the lieutenants at the head of the company.

The Japanese soldier carefully follows the principles of hygiene. The barracks are kept reasonably clean and blankets and other bedding aired in the open every day. Particular care is taken of the feet and socks are changed twice a day whenever possible. All men bathe every day in summer and winter and despite the fact that each man has to do his own laundry work clothing is clean from a hygienic standpoint and underwear is changed every day or every other day.

The Japanese soldier is particularly careful to change shoes and clothing at once if he is caught in a rainstorm. He seems to have a particular dread of getting his chest or abdomen wet by rain and will make every effort to keep these portions of his body dry.

Cooks are carefully examined by the company commander every day to see that the hands and finger nails, as well as clothing, are kept clean. Bunks in barracks, however, are arranged head and head instead of alternately head and foot as in our army. They are also closer together

and in summer are not more than eighteen inches apart due to the fact that one huge mosquito bar is used to cover all the bunks in a squad room.

The Japanese soldier receives quite thorough instruction in first aid. He knows the location of the various parts of the body where the arteries are near the surface and is familiar with the tourniquet and other means of stopping heavy bleeding. He can treat dislocations, sprains, and fractures in a crude but efficient sort of way and always knows the antidotes for various poisons. The men are quite skilled in applying bandages to wounds and when doing so carefully guard against infecting the wound.

He is very carefully instructed as to what to do in case of a sunstroke. He is unusually skilled in transporting wounded, and can improvise litters from coats, blankets, tents or other articles of clothing and equipment in short order.

The Japanese soldier probably has a better knowledge of first aid than the American soldier possesses.

In the field and on the march the ration consists of rice and wheat in the proportion of seven portions of rice to three portions of wheat. The whole is mixed up and boiled in huge cauldrons and ladled out to the men three times a day. This ration is known as "shichi bu no san" and is the staple diet in barracks also. Bread may be fed to the men once a week but this is not compulsory. The men, as a rule, have little liking for it. The Japanese soldier's total daily ration costs about twelve cents gold. An American soldier would starve on the fare the Japanese seem to thrive on. Nothing but hot water is drunk with meals. Men enter and leave the mess hall in formation.

The Japanese maintain, and rightly, that the lessons of the World War have not been thoroughly digested, that even the most modern arms and equipment are still subject to suppression by something more efficient, and that such suppression is going to continue until weapons and equipment are developed that will be considered equal to the demands of the next war. England, France, and America are developing such weapons but have not perfected them.

Japan has no great financial resources and the army officers state that no money is available for experimenting in the development of weapons. As it is, the army and navy accounted for one half the total budget last year. On the other hand the Japanese realize that when they depend on copying from others they must always be one step behind the originators and can never take the lead themselves.

The Japanese Marine

Engineering, 26 February, 1926.—The entry of Japan into the list of great powers has been accomplished so thoroughly that it is not always remembered how remarkably it has been delayed. The economic history of the country may be said to have anticipated, on a highly magnified scale, that of the modern British motor-car industry in its first stages. Not through any intrinsic defect, but by the interference of the legislature, that industry was prevented from taking the place that would have been open to it had it been free; and what happened to this one industry merely repeated for a short time what had happened to Japan for something over two centuries.

No part of the social and economic growth of Japan was checked more directly and effectively than its shipbuilding and navigation. At the beginning of the seventeenth century Japan was not in the first rank of nautical countries, but its geographical circumstances no less than the natural ability of its inhabitants had given it a long tradition of sea life, and there seemed to be no reason why its mercantile and naval marine should not have progressed as well as those of other countries. It seems,

indeed, to have had some thoughts of such a destiny. At the present moment attention is being called by an influential British committee to the absence of a memorial to Will Adams—not the legendary personage associated with the Battle of Waterloo—but the first Englishman to visit Japan, a pilot who spent the first twenty years of the seventeenth century there, and seems to have begun building ships for the great Shogun Iyeyasu on European lines. In 1636, however, the rulers of the country adopted the definite policy of prohibiting foreign intercourse. They would neither allow access to foreign ships nor, except under rigorous restrictions, permit Japanese ships to be built for foreign travel; and when the system began to come to an end, in 1853, the greatest ships were scarcely larger than had been built before it had been adopted, more than two centuries earlier.

In a paper read this week before the Japan Society, Professor F. P. Purvis presented a large number of particulars regarding the ships built at various stages of Japanese history, and collated them with a summary of the growth of the shipbuilding and navigation of the country in recent years. Not the least interesting part of this paper is that devoted to the earlier periods, going back to what apparently were prehistoric times, and exhibiting in the Japanese of those days the same remarkable receptivity for the ideas and practices of other nations in matters of shipbuilding, as they have shown in recent times. His account, however, of modern shipping, given with the insight and authority of his long experience of shipbuilding and his intimate connection with its development in Japan, has a more practical interest. It shows some incidents, arising naturally enough out of the circumstances, that may have saved those who were engaged in that development some trouble that their colleagues in other countries have had to undertake. When, for instance, Japan began seriously to entertain the use of steamships, the use of screw propellers was well established, and though for other countries they had not displaced paddle wheels, the advantage of propellers was sufficiently manifest to warn the Japanese off paddle wheels altogether. At the time, again, when practice in shipbuilding was changing over from iron to steel, Japan has not got much beyond wood, and when it was ready to build metal ships it went straight into steel, and short-circuited the iron ship as it had the paddle wheel. For the most part the development of the Japanese naval and mercantile marine was the result of intensive efforts, both technical and fiscal, which led to results that were correspondingly impressive.

The first modern ships were built in Japan in 1854, when a Russian man of war was wrecked through a tidal wave following on an earthquake, and her commander built another with the help of Japanese artisans, who were afterwards employed on the new art for the service of their own country. It was not, however, until the war between Japan and China in 1894-95 that shipbuilding began to be taken seriously. In the former year it was found necessary to buy from abroad some 96,000 tons of shipping, which was probably several times as much as the country already possessed. With the victorious ending of the war the industry and navigation of the country expanded sharply, and in 1896 the Diet passed Acts granting subventions to shipbuilding and navigation for a period of eighteen years. These subsidies were devised with a keen eye to encouraging not only the volume but the efficiency of the industries in question. While 20 yen per gross ton was paid for iron or steel vessels of 1,000 tons and upwards built in Japan, only 12 yen was allowed for vessels between 700 and 1,000 tons, though to ships of both sizes a further 5 yen per ton was given for every horse-power developed on the official trial. For navigation, again 25 sen was paid per 1,000 miles for ships of 1,000 tons gross and 10 knots speed, with an addi-

tion for every 500 tons and every knot, up to 60 sen for 6,000 tons gross and 17-knot speed. For ships not built in Japan only half these subsidies were paid; and for ships over five years old a reduction of 5 per cent was made for each subsequent year up to a total age of fifteen years, when the subsidy ceased. In 1910 new scales of subsidy came into force, which were still more drastic in their requirements. The minimum for the construction subsidy was raised to 1,000 tons, at which 11 yen was granted, rising to 22 yen with size. The official trials for speed bonus were to be made with a load equal to half the ship's deadweight on board, and a great deal of gear and apparatus had to be home made. For cargo ships the minimum size for bounty was raised to 3,000 tons and the speed to 12 knots, but the scale of bounty seems on the whole to have been more liberal. In round figures the navigation bounties reached a maximum of about £2,000,000 in 1913, falling ultimately to something over half in 1922; the construction bounties rose year by year after 1910, reaching nearly £1,000,000 in 1917, when they ceased. The navigation bounties have been continued and in some instances increased.

No doubt can be felt that, whether the results are or are not worth what they have cost, they are very striking. The steamships and motorships owned in Japan are nearly three and a half times the tonnage that they were in 1909, and though a long way behind the United Kingdom and the United States, rank next after them in the mercantile marines of the world. The number of well-equipped yards is such as could in need turn out a much greater tonnage at short notice. During the war many vessels were built in extraordinarily short times. In one instance a 9,000-ton ship was launched twenty-three days after she had been laid down, doing her steam trials six days afterwards at over 17 knots; and though this was the fastest production, others were of the same order of promptness. In naval construction progress has been no less marked. Japanese naval activity, already in steady progress, took a fresh impulse after the war with China. The construction of yards as well as of ships was pushed on, so that less and less had to be bought from other countries, and of late years ships built in Japanese yards have more than once been the heaviest or the most powerful in the world at the time they were launched. And the most remarkable of these arresting facts is that the work has been done, and done thoroughly well, in little more than a quarter of a century.

For the time being shipping enterprises are not at their best; but it can hardly be imagined that a country which has done so much so well and in so short a time will remain where it is when things mend. Professor Purvis's opinion, which he is in an exceptionally good position to form, seems to be that among the problems that Japan has to solve if she is to maintain and continue her marine development are those relating to labor. They do not seem to be the same as our own. The doctrine of restriction of output seems to have as little attraction for the intelligent Japanese workman as it has for the American. Perhaps he is thinking more of security of employment; and when it is remembered how gravely that security is jeopardised by the practice of demarcation of trades, Japanese industry seems to have an easier problem than if it had to deal with restriction and demarcation, from which British workmen suffer no less than British industry. But whatever may be the problems of competing countries, Professor Purvis touches the root of the matter when he says that the country in which all parties to industry understand and adopt sound economical conditions will prevail over those that do not. International agreements regarding labor may do much, if they are not only made but observed. What they cannot do is to supersede economic or any other natural laws and give labor, or any other service, or commodity, a higher value than it possesses in the exchanges of the world.

AVIATION

Technical Progress in Aeronautics

Mechanical Engineering, April, 1926.—At a time when so much discussion and investigation is being made of aeronautics in general, some useful purpose may be served by taking account of stock of the progress made from the technical standpoint. In a paper of this scope it will be impossible to give full credit to all responsible for the particular development, for all individuals actively engaged in aeronautics have more or less responsibility with some development.

In general, a remarkable advance in aeronautics has occurred year after year. Of late years, however, although the greatest amount of credit must be given airplane and engine designers for their untiring work in refining the conventional atricle, the final performances obtained have nevertheless been largely due to the cooperation of flying maintenance, mechanical, and inspection personnel. Development, as the majority in the United States know it, dates from our entry in the World War. Progress has since then been of two periods: post-war; digesting the practical and theoretical data and experience, to form a firm scientific foundation; and thereafter trying pure American ideas, design, and building, until we stand ready to "go into production" on a safe and sane program, commercial and otherwise. We have now reached the stage where design in aviation can be considered an economical procedure.

Airplanes

The trend of airplane construction may be summed up as a greater refinement and a general reduction of exposed structure, accompanied by a larger span. (See Fig. 1.) A "split" landing gear or rather an individual

Fig. 1 The Douglas C-1 Cargo-Type Airplane

(The single-bay, long-span wings and "split" landing gear represent tendency. This plane will carry 8 persons and baggage by means of one Liberty engine.)

structure of support for each wheel is common practice. Biplanes continue to predominate chiefly because monoplanes seem to have given excess trouble by fluttering or in torsional deflection. A tendency toward monoplanes is developing for heavier-duty airplanes, in which a more rigid internal trussing is practicable. Pursuit airplanes have become essentially, one and one half plane machines, as a compromise, to avoid flutter and still retain excellent visibility. So that, if it is permissible to

generalize, biplanes may be said to predominate in the case of observation and racing airplanes and seaplanes, but seem to be losing ground elsewhere. We find the biplanes having single-bay, long-span construction.

Effect of Large Fuselages on Performance

With increase in sizes of fuselages for purposes of transport, an interesting complication has arisen. At McCook Field in the case of a military transport it was found that gearing down a propeller from direct drive to a ratio of 2:1 resulted in an increase of 10 miles per hour in high speed and 340 feet per minute climb at the ground. Whether this is due to propeller-body interference or to a greater propeller efficiency at slower speeds, or a combination of the two, is not definite. It would seem that a slower speed and therefore larger propeller diameter would automatically place the most efficient part of the propeller well away so as to prevent any possible interference to the slipstream by the nose of the body, resulting in what some term gerater *propulsive efficiency.*

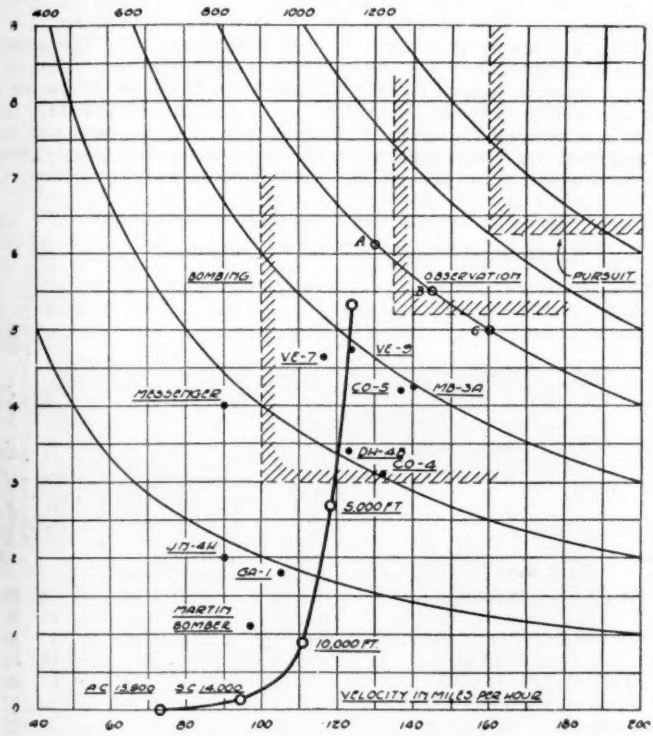


Fig. 2 Maneuverability Chart

(The maneuverability factor based on ability to execute a sharp turn quickly is plotted on the ordinates R/r, R being rate of climb, ft. per min., and r the minimum radius of steady turn in horizontal flight, ft. This serves to group distinctive classes of airplanes. The value for the commercial plane should be near that of the Martin bomber.)

TABLE 1 DATA ON A T-3 L.W.F. MILITARY TRANSPORT

	Direct drive	Epicyclic gear	2:1 Spur reduction gear
Diameter of propeller, ft.	10.5	14	15
High speed at ground, m. p.h.	98.7	(1855 r.p.m.) 102.7	(1900 r.p.m.) 108.3
Absolute ceiling, ft..	(1625 r.p.m.) 10,300	(1600 r.p.m.) 12,650	(1595 r.p.m.) 11,400
Climb at ground, ft. per min. ..	280	550	618

MANEUVERABILITY

A study of the maneuverability chart devised by Kerber and shown in Fig. 2 will give a very good idea of airplanes and their flying qualities. In military airplanes, maneuverability is a quality much sought for, but for commercial and transport craft it is quite secondary. The factor shown furnishes a definite basis for designers to work upon, and therefore represents a forward step. Likewise it furnishes a basis for comparing airplanes of widely different characteristics. The maneuverability factor involves in a measure the question of excess power, which must necessarily be a minimum for economical work, this minimum being largely dictated by the landing fields for take-off and the mountains to be traversed. Con-

TABLE 2 DESIGN LOADS FOR MAJOR ASSEMBLIES

(Engineering Division Load Factors, April, 1925)

Designation.	Type name	Load factor for: High Incidence	Low Incidence	Inverted flight	Landing condition	Ribs in medium incidence	Leading edge	Height of free drop for shocking absorbing units, in.	Ailerons and horizontal tail surfaces, lb. per sq. ft.	Vertical tail surfaces, lb. per sq. ft.
P	Single-seater pursuit	12.0	6.5	4.0	7	9.25	14	24	35	30
O	Two-seater observation	8.5	5.5	3.5	6	7.0	10	21	30	25
NO	Two-seater night observation	8.5	5.5	3.5	6	7.0	10	21	30	25
LB	Light bombardment	5.5	3.5	2.5	5	4.5	8	18	25	20
HB	Heavy bombardment	4.5	3.0	2.5	5	3.75	6	18	20	15
PT	Primary training	8.0	5.5	3.5	7	6.75	14	24	35	30
AT	Advanced Training	8.0	5.5	3.5	7	6.75	14	24	35	30
C	Cargo	5.5	3.5	2.5	5	4.5	8	18	25	20

NOTE: Seaplanes shall be designed for the same load factors as land airplanes of the same function, in all loading conditions common to both types. For loading conditions applicable to seaplanes only the load factors and methods of computation approved by the Bureau of Aeronautics shall be used. This includes catapulting.

sequently commercial machines might be placed directly beneath the bombers—that is, the same speed but a lower maneuverability factor. Reduction in maneuverability below a certain value would mean a lessening of safety in case of engine trouble, and especially so in multi-engined machines.

Structures

Hand in hand with the progress in performance and maneuverability in aircraft must necessarily advance the study of airplane structures. By means of static testing or proof loading the actual strength of the completed structure may be checked, be it fuselage, wing, tail surface, tail skid, landing gear, or a combination thereof. Continuous study and the accumulation of statistics in static testing have evolved a series of load factors for various conditions and parts for each type of military airplane. The cargo type in Table 2 represents the commercial airplane. Some of the factors given are very rigid, but it is realized it is better to have them and modify them only when a specific design might be improved thereby. This makes for progress with safety.

Conventional airplanes are no longer loaded to destruction. Doubtful or new combinations of structure or untried parts and materials are loaded usually to destruction, but sometimes tested only for certain readings of deflections under increments of load.

Landing Gear

It will be noticed that in Table 2 the ninth column gives the height of free drop for shock-absorbing units. These are values for use in testing the chassis in supporting the fully loaded airplane fuselage without wings. The height given is the final height reached after successive drops increasing from three to six inches each time. The tail of the fuselage is slung from a superstructure. The landing gear strikes a platform having an inclination of 9½ deg. to the horizontal to simulate conditions occurring in a cross-wind landing. It is of interest in this connection to mention two tests on two types of landing gear attached to the CO-6 airplane. One

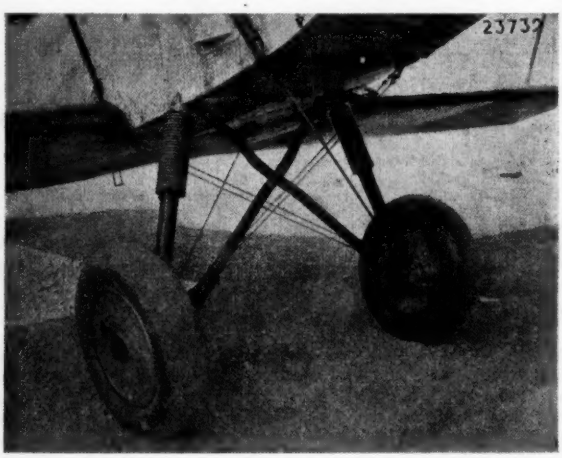


Fig. 3. The Oleo Shock-Absorbing Landing Gear on the CO-4
(A tendency to "lean over" in sharp turns on the ground has been overcome by a cable limiting the movement.)

was equipped with shock absorbers and the other was not, the structure for the latter being increased somewhat and large tires being used to take the increased shock. Both chassis passed the drop test successfully, and the balloon tires of the second were sufficient to absorb the entire shock of landing without the usual rubber shock absorbers.

There is a decided tendency at present to simplify the landing gear by eliminating the old floating cross-axle and hinging the individual axle at the fuselage so that each wheel is attached in a separate unit. Although this is more complicated and is hard on the fuselage structure, it is necessary to avoid trouble in landing. The shock absorbers in many cases are brought up into the fuselage. The Oleo shock-absorbing apparatus (Fig. 3) has been successfully used on the CO-4 for more than a year, and it is quite probable that this will replace the prehistoric rubber shock absorber in commercial practice.

Accelerometer Tests

Tests in actual flight by means of accelerometers have been the basis for determining most of the load factors of the Engineering Division. Lieutenant Doolittle made a considerable number of tests and obtained

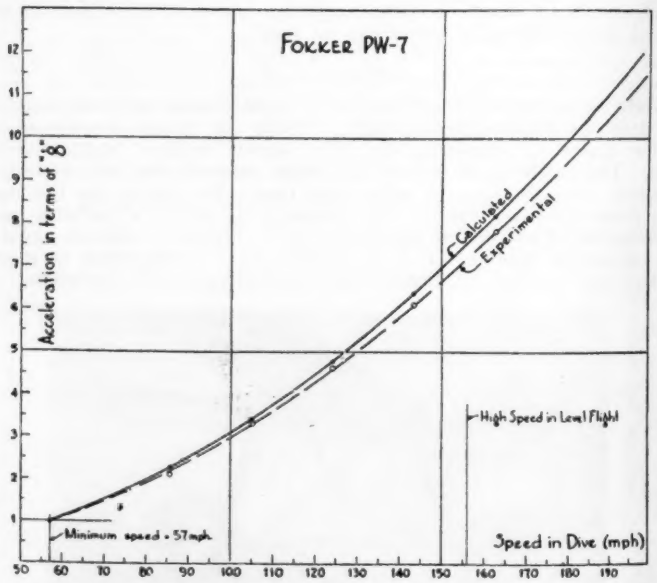


Fig. 4. Calculated and Observed Accelerations in Pulling Out of Dives

observations on a Fokker PW-7 single-seater pursuit airplane in various maneuvers. Static tests of the airplane used showed that it could withstand nine times its weight in loading. The highest velocity attempted in dive was 162½ miles per hour. From a series of lower air speeds data were obtained from which a curve (Fig. 4) was plotted showing the variation in the increase of accelerations with the speed in pulling out of a dive. Considering the high speed in level flight in this particular case as 157 miles per hour, it was evident that the margin of safety for pursuit airplanes was not sufficient, and consequently the Engineering Division

requires a factor of 12. The accelerations recorded in barrel rolls are also very instructive. The greatest loading obtained in this case was in starting the roll at 160 miles an hour and pulling back sharply on the stick with the resultant acceleration of 7.2*g*, identical with the loading pulling out of a dive. Accelerometer readings in landing were taken on a JN-4H. The results showed a maximum loading of 2.7 for a smooth three-point landing and 5.2 for a tail-high landing. A material factor of 2 is used in comparing acceleration loads with the load factor.

Advances in Aerodynamics

The most noteworthy advances in aerodynamics center about the applications of theoretical hydrodynamics. Professor Witozinsky[2] has taken the classical hydrodynamical theory and introduced practical checks on the theory at various stages so as to make the theory correspond with known facts, step by step, such as relocating the boundaries and points of discontinuity and stagnation. Laboratory tests of pressure distribution in the Eiffel Laboratory have confirmed the theoretical values of Witozinsky as being unusually close to the experimental and within the allowable error in aerodynamics.

Prandtl's methods of calculating the drag and differentiating between profile and induced drag have influenced design so that the term "span loading" of an airfoil is spoken of rather than "aspect ratio." In the calculation of the drag of an airfoil for predicting airplane performance, the profile drag of the wings may be considered constant for all angles of attack in flight, and is calculated under the heading of parasite resistance. The following equation is used as the basis for calculation:

$$C_D = \frac{C_D^2 \times \text{Area}}{\pi \times (\text{Span})^2} + C'_D$$

In this equation the first term gives the induced drag and the second term the profile or friction drag. It is evident that the term for induced

Fig. 5. The New Altitude Airplane XCO-5

[This plane has the high-lift wing section (S. T. Ae. 27a). Note the side-type exhaust-driven supercharger. Duralumin sheet used on leading edge of wings in place of veneer. Pilot's cockpit weatherproofed and heated from engine.]

[2] *Revue Générale de L'Aeronautique*, Number 4, 1924.

drag can be reduced to an expression involving aspect ratio, if desired. A convenient formula is—

$$\text{Induced Drag} = 125 \frac{(\text{Lift})^2}{(\text{Span})^2 \times (\text{Velocity})^2}$$

(Units: lb., ft. m.p.h.)

The tendency to reduce exposed structures coupled with the desire for a large span has led to the adoption of semi-thick and thick wings in the modern airplane. An airplane has been built, the XCO-5 (see Fig. 5) designed particularly for altitude performance. It has a semi-thick wing section with high lift characteristics and particularly good L/D at high angles of attack. It is possible that an airplane with this type of characteristics may lead to other developments.

Stability

A study of longitudinal stability has been made at McCook Field by Mr. Dormoy. By a consideration of stick forces and pitching moments, and by making careful tests of a large number of different airplanes and studying the curves obtained therefrom, it has been made possible to predict, with sufficient accuracy, the longitudinal stability of an airplane being designed. The results are purely practical and serve the dual purpose of making possible the design of a good flying airplane and also correcting defects in existing airplanes due to poor judgment.

Materials—Metal vs. Wood

The metal airplane is continuing to gain in favor. Metal wings have not exhibited sufficient advantage over wood wings of the size which is common at the present time. There is also considerable opposition, although not yet put to practical test, to mental covering of wings. However, an experimental observation airplane made entirely of metal has just finished its static proof loading, and this airplane represents a compromise in that the lower surface of the wings is to be covered with fabric and the upper surface, including the leading and trailing edges, with corrugated aluminum. This is made necessary for maintenance and inspection purposes.

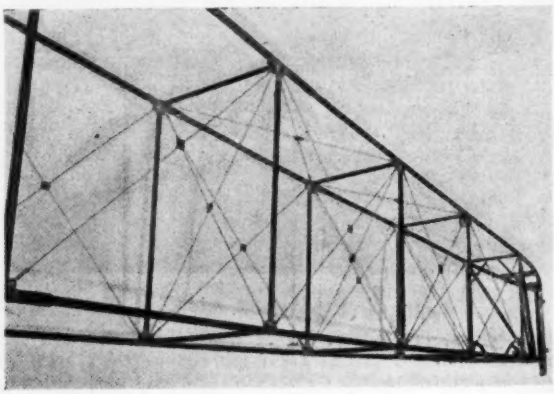


Fig. 6. A Typical Welded Steel-Tube Fuselage with Cross-Brace Wires

Fuselages

The steel-tube fuselage (Fig. 6) has become quite common, and is now being improved by substituting chrome-molybdenum steel, which allows a further saving in weight due to its higher strength and at the same time is readily welded with less detriment than other steel.

	Tensile strength, minimum, lb. per sq. in	Yield point, minimum, lb. per sq. in.
Chrome-molybdenum steel tubing	95,000	60,000
Ordinary steel tubing of 1025 steel	55,000	36,000

Some of the larger fuselages are now being built with an all-tubular framework without wires (Fig. 7). A typical example of improvement is

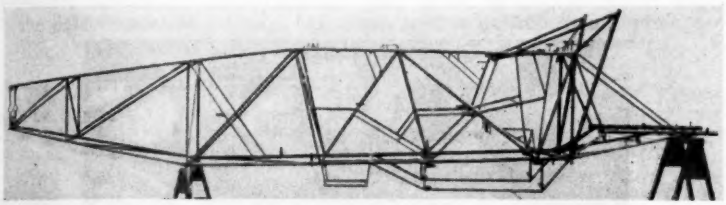


Fig. 7. A Welded Steel-Tube Fuselage of the Rigid Type Without Cross-Brace Wires

the steel fuselage for the DH-4 which weighs 245 lb. including the covering, as against the old-style fuselage weighing 325 lb. Duralumin fuselages (Fig. 8) are made up of tubes riveted into fittings or by means of corru-

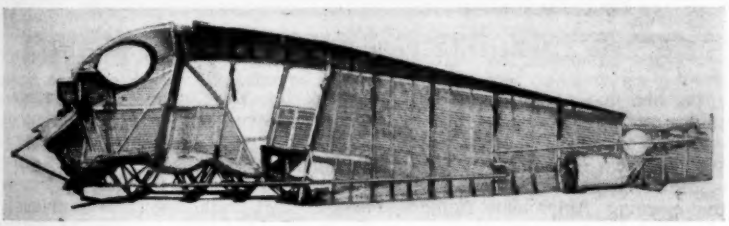


Fig. 8 Cross-Section of a JL-6 Fuselage Showing a Type of Built-Up Bulkheads with Corrugated Duralumin Shell

gated aluminum coverings and stamped bulkheads with structural bracings. It is difficult to say whether duralumin will gain favor in the immediate future over alloy-steel tubing or not.

Wings

The solid-wood I-beam for wing spars is being supplanted by the box spar, due in a measure to increase in span accompanied by a limitation to single-bay structures and also to thicker wing sections. The difficulty in developing a satisfactory metal spar lies in the fact that the metal used in these individual sections to carry the stresses is subject to local failures by buckling or crinkling. Since the Air Service is not ready to replace fabric

wing covering by metal sheet due to maintenance complications, individual spars have been built and tested under standard loadings. As a result of a series of tests on spars 15 in. deep designed to carry loads in a heavy bombing plane, it has been found that the spar built by chome-molybdenum steel tube and one having duralumin-tube flange members (Fig. 9) and a steel-tube web show up the best from the standpoint of weight of spar to load carrying. The welded chrome-molybdenum spar is slightly stiffer and it is not subject to as high secondary stresses as the combination type. In the same series of tests there was a duralumin spar and built up girder structure which showed up remarkably well. The Engineering Division has also tested an extruded I-section design for a lighter loading and found that it would work satisfactorily. Several types of extruded beams are being further tested to develop a type which will be satisfactory for observation airplanes. Duralumin box spars, open channel structures, and plate-girder spars are the best metal type, so far, for 6¼ in. depth. Extruded

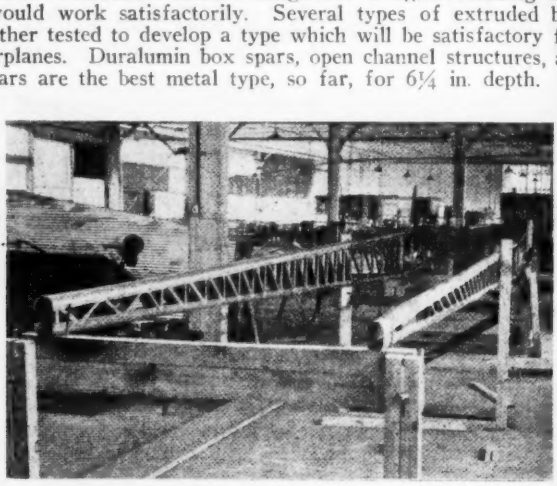


FIG. 9 A BUILT-UP RIVETED DURALUMIN WING SPAR

spars are good only in shallower types. The development of duralumin tubing and its subsequent use in airplane construction, the development of extruded shapes, I's, bulbs, angles, etc., for wing beams and struts represent progress in new materials for airplanes.

Metal ribs have been used satisfactorily, and we find them at present on the Loening Amphibian stamped out of sheet duralumin. Duralumin is also used for a veneer substitute on the leading and trailing edges of certain wings.

It has been stated that military airplanes could be of flimsy construction because they are not constantly in the air, and that therefore the commercial airplane should be heavier in order to be rugged and require less maintenance. It is believed that this particular point is a little misstated and should rather read that although military airplanes require higher load factors for the maneuvers to which they are subjected, yet in order to obtain high performance and efficiency it is necessary to build more efficient though less rugged structures even if the cost of fabrication and maintenance becomes slightly increased.

GASOLINE TANKS

The question of reducing weight has affected the choice of material in building gasoline tanks. The following comparative figures, as conservative

values for average-shaped tanks of 90 gal. capacity, show striking improvement:

	Lb. per gal., approx.
Terne plate	1.00
Aluminum, welded	0.60
Duralumin, nickel plated, soldered, and riveted	0.35-0.40

A 60-lb. saving in weight can be shown in this phase alone.

Magnesium Alloys

The development of a practical method of casting magnesium alloys has made possible their use for at least experimental purposes for supercharger casings, instrument and camera casings, and the like. Magnesium-base alloys usually weigh approximately 65 per cent of those of alumninum. They have a number of unusual characteristics which might be termed disadvantages in the light of present practice, but which are not difficult to overcome.

Corrosion Prevention

The use of metal structures at once brings up the problem of fatigue and of corrosion. The former is being given considerable study—no new conclusions are available at this time. Protective coatings based on work in corrosion prevention are recommended as follows:

Steel Tubing. Interior protected by filling with hot linseed oil after welding.

Steel, Aluminum, Duralumin. Two coats primer, iron oxide, or aluminized varnish. Basic pigments, as red lead, are not to be used on duralumin.

Aluminum and Aluminum Alloys. When exposed to an unusual service, viz.: in gasoline and cooling systems, and to salt water, Z-D process, consisting of baking in a water-glass solution. This is used for carburetor bowls.

Magnesium Alloys. Necessary to prepare the surface first by Parkerizing, forming a magnesium phosphate or dilute nitric acid; then apply enamel or duco.

Anodic Treatment for Aluminum and Duralumin. Consists of passing an electric current through a solution of bichromate of potassium, using the metal as the anode. The current is passed at 35 volts rising to 60 volts in one hour. Anhydrous oxide is believed to result. This is now undergoing extensive salt-spray test.

Plating. Cadmium plating on various metals has proved as good with a 0.0003 in. thickness as zinc plating with 0.001 in. Consequently it is more convenient to use cadmium, especially in the case of close fits, without the necessity of undercutting to allow for the plate.

Gasoline

Specifications for aviation gasoline now call for a maximum allowable critical solution temperature with aniline of 61.5 deg. cent.

Naphthene should be a maximum and paraffin a minimum for the best anti-knock quality in gasoline. This is tested by the relative lowness of the temperature of critical solubility of the gasoline in aniline.

Paraffin : Napthene	Critical temperature	Source (typical)
50:40	40 deg. cent.	California
80:15	66 deg. cent.	Eastern

Engines

The most successful aircraft engines at the present time are really refinements of types available for some years past. Some of these improvements are greater compactness, resulting in lighter weight and greater

rigidity; higher crankshaft speeds; improvements in valve-operating mechanisms, valve cooling, and valve materials; improvement in bearing design; and improvement in volumetric efficiency. The success of the inverted engine of the air-cooled V-type, of reduction gearing, and of the rotary inductor supercharger, has contributed the largest share to recent progress with engines.

TABLE 3 TYPICAL VALUES ON TYPICAL ENGINES

	Maximum service r.p.m.	Brake mean effective pressure, lb. per sq. in.
Liberty-12	1700	115-120
Aircooled Liberty	1800	125
Curtiss D-12	2000[1]	140
Curtiss V-1400	2100-2500	140 (estimated)
Packard V-1500	2100-2300	135
Packard V-2500	2000	135
Curtiss R 1454 (radial aircooled)	1800	135

[1] The D-12 has been run successfully at 2800 r.p.m.

Crankpin forces run about 1000 lb. per sq. in. of projected area with a rubbing speed about 35 ft. per sec., giving a value of pv=35,000. The Liberty-12 uses about 25,000, whereas the high-speed D-12 has experimentally run up to 50,000.

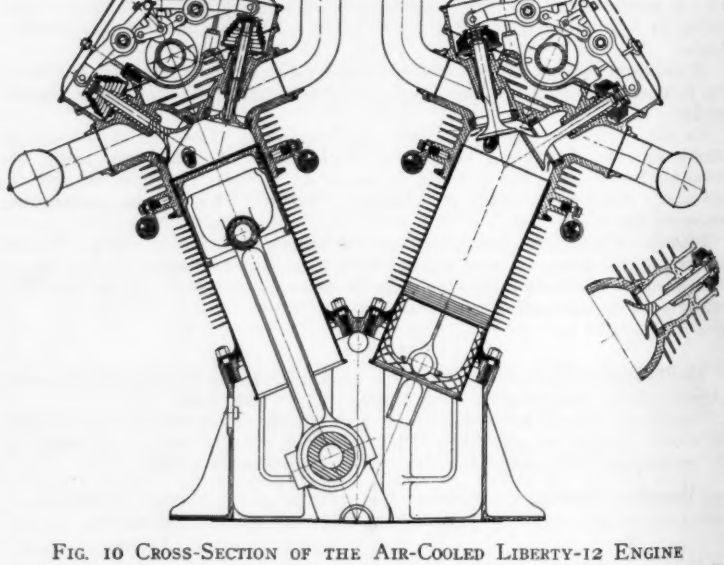


FIG. 10 CROSS-SECTION OF THE AIR-COOLED LIBERTY-12 ENGINE

(The totally enclosed valve-operating mechanism and the salt-cooled exhaust valve are shown. Note the steel sleeve and lower cylinder, and cast-aluminum head. Intake is from the outside of the V, and exhaust through the inside of the V, or opposite of standard water-cooled-engine practice.)

Bronze-backed bearings are being supplanted by steel-backed ones for greater rigidity of support. For rigidity also outside diameters of crankshafts have been increased.

The type M air-cooled cylinder developed by the Engineering Division has many typical features. The valves, which are both of glass-hard tungsten-steel guide bushings. The exhaust valves are internally cooled by a mixture of sodium and potassium nitrates contained in the hollow stem. The enclosed force-feed lubrication, constant-clearance valve gear is a very important adjunct. The pistons for aircraft engines are coming out with shorter skirts so as to be in style. The mean effective pressure for the single cylinder at 1800 r.p.m. runs between 145 to 155 lb. per sq. in. The success which has attended the work of the air-cooled Liberty-12 with its efficient cooling system eliminating cooling trouble in the rear row of cylinders, has justified the design of a 24-cylinder X type air-cooled engine

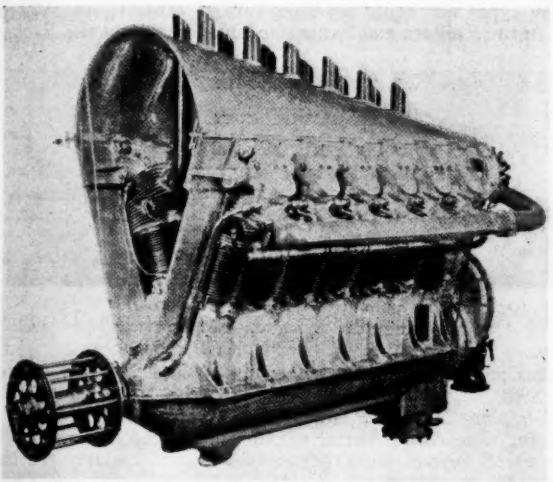


FIG. 11 THE AIR-COOLED LIBERTY-ENGINE WITH THE WIND SCOOP
(Note the single carburetor and centrifugal distributor at the rear.)

of 4520 cu. in. displacement, which is now in the process of construction (see Figs. 10-12). In addition to having cylinders similar to the type M cylinders, it will have a crankshaft of large diameter using roller bearings for the main bearings and plain ones on the rods. It will be equipped with centrifugal supercharger and reduction gear. It is estimated that it will weigh 2 lb. per hp., including the accessories and supports.

GEARING

The aircraft industry has taken advantage of the improvements in the gear-cutting industry so that highly reliable reduction gears have been obtained weighing somewhat less than 0.2 lb. per hp. Although gearing was employed during the war in Europe, it has been only recently that it could be adopted without considerable increase in the weight of the power plant. Typical reduction gears show tooth speeds in the vicinity of 3500 ft. per min. accompanied by tangential loads of 2000 lb. per in. of face width. The combination of hardness, strength, and accuracy has only recently permitted operation under these severe conditions. Shock-absorbing couplings have

been found necessary to protect the gears from the effects of violent engine-torque variations. At the present time spur gears which show a 20-deg. pressure angle are being employed.

Radiators

Radiators slung under the engine at an inclination to the vertical have been developed and tested so that now these tunnel types are considered as having practically no more resistance than wing radiators.

Special Engines

Progress on engines will not be completely reported without mentioning the advancement in producing the 500-hp. Packard No. 1A (1500 cu in.), weight 710 lb.; and the 800-hp. No. 1A (2500 cu. in.), weight 1135 lb.; and the Curtiss 500 hp. No. V 1400, weight 660 lb. Experimental engines of the above types are being used on various projects, the V-1400 having been flown in the Pulitzer and Schneider Cup Races, and the Packard engine

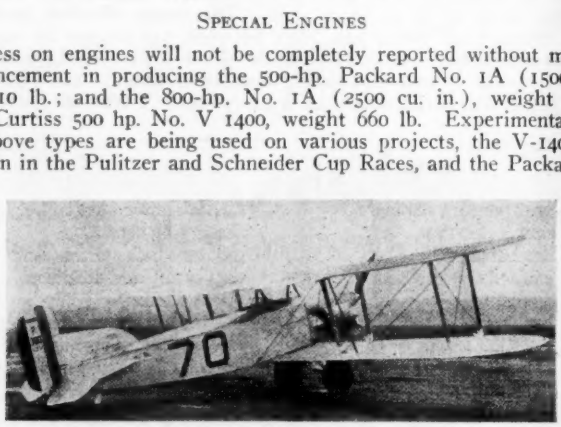


Fig. 12 The Air-Cooled Liberty Engine Installed Inverted in an Observation Airplane (XCO6-C)

(This makes possible a high center of thrust and better vision forward.)

in the PN-9 planes. These engines are being further tested with and without gears. The Almen barrel engine has completed certain tests, but is not yet advanced beyond the experimental stage; similarly the cam engine which substitutes a cam mechanism in place of connecting-rod devices, making for simplicity. The Curtiss air-cooled radial R 1454, delivering over 400 hp., has finished 20 hours with minor failure in master connecting-rod assembly.

Propellers

With the increase in engine speeds must go increase in propeller speeds unless gearing is resorted to. This has been met very effectively by the use of drop-forged aluminum-alloy propellers which make possible the use of very thin sections. Wind-tunnel tests show that there is no comparison in efficiency between the thin and thick sections, and with tip speeds between 700 and 800 miles per hour the metal propeller has actually displaced the wooden one, giving from 5 to 10 miles per hour increase in airplane speed.

These propellers may be made up with split hubs and with separate blades. From the service viewpoint it is highly desirable for the propeller to have blades which can be separately removed, in consideration of transportation, repair, and interchangeability for different types of airplanes, etc. With various adapters the same propeller blades can be used for various types of engines and airplanes within certain limits, and the angles of pitch settings adjusted at the hub accordingly. This development has instigated another development in the case of larger and medium-speed engines by the experimental use of magnesium with a saving in weight of approximately

one-third. In the case of very large diameter and slow-turning propellers, especially for airships, built-up propellers have been made up to 25 ft. in diameter with balsa-wood core covered with strips of veneer.

It is now possible to make an efficient light weight, three-bladed propeller which is useful for pusher installations, and which may find its place as a compromise between the two and four-bladed propellers.

Standard wooden propellers which were formerly covered by aluminum leaf applied by hand to protect the wood against moisture changes, are now being finished with a varnish containing alumninum powder and giving practically the same results with less cost and effort.

Aircraft Equipment—Manifolds

A large number of crash tests have been made by the Engineering Division by running worn-out airplanes at high speed against a thick concrete wall. A very thorough study of this has been undertaken, using the slow-motion movie camera for observing each test (see Fig. 13.) The DH-4B airplane has been the most common offender in catching fire after wrecks,

Fig. 13 One of the Numerous Crash Tests Run at Dayton in the Interest of Elimination of Fire Hazard in Wrecks

(Note the aluminum air-cooled exhaust stacks which have been developed through these tests, and with which no fires have resulted.)

and so the results of that type alone are given. Out of nine DH-4B's with various types of exhaust manifolds, there resulted five fires. Four of the nine were equipped with standard stacks as used in the service today, and three of the four took fire. To show that the fires were due to the hot exhaust manifolds, eleven were crashed with no manifolds, with no fires resulting. It being necessary to have some sort of manifold air-cooled exhaust stacks were designed and fitted as shown in Fig. 14. Ten planes so equipped were crashed and no fires resulted. It is believed, therefore, that it will be highly desirable in case of commercial aircraft to have air-

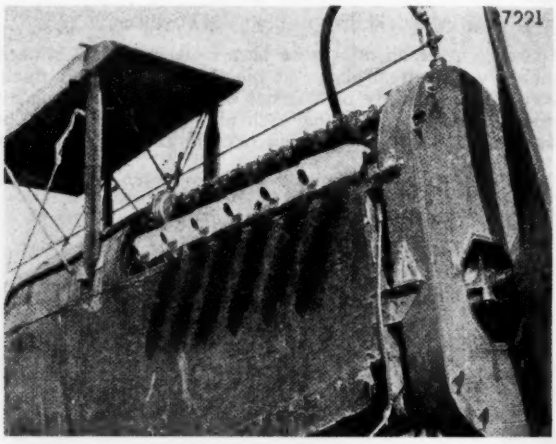


FIG. 14 A CLOSE-UP OF THE AIR-COOLED ALUMINUM EXHAUST STACKS INSTALLED ON A LIBERTY-ENGINED DE HAVILLAND PLANE

cooled exhaust manifolds, not only for the fire-hazard elimination but for reducing the noise from the exhaust of the engines.

PHOTOGRAPHY

Photographs have been successfully taken from the air at night by means of setting off a 35-lb. flashlight charge towed behind an airplane flying at from 2000 to 3000 ft. altitude. These photographs show the ground in a very clear manner and will undoubtedly change the practice somewhat of moving troops under cover of darkness, since the cover has been removed.

By means of a new process it is now possible to take a photograph in the air, develop and print it, and deliver it by dropping it from the air within ten minutes after exposure. The photograph can be used as a negative also if desired.

A preliminary test has been run showing unusual promise in haze penetration in aerial photography with the new kryptocyanine film which is sharply sensitive in the infra-red only.

The four-lens mapping camera has been put on a status of production. The advantage of the four-lens camera is obvious.

INSTRUMENTS

Instruments for aerial navigation in any kind of weather are being developed, and considerable progress is being made. Long navigation flights have been undertaken with instruments now available, sometimes as much

as four hours at a time being out of sight of land, and yet finished not appreciably far from the calculated course. For long flights accurate meteorological information is very necessary, especially as regards winds at altitudes.

The induction compass has successfully demonstrated its value since it allows an accuracy within 1½ deg., whereas the accuracy of the ordinary magnetic needle compass cannot be closer than 5 deg. The induction compass employs the principle of a rotating coil which seeks to maintain a definite position with respect to the earth's magnetic field. This instrument has now been placed on a production status.

An automatic recording compass and log has been experimented upon and has successfully recorded the air course traveled by an airplane.

The most difficult problem which is as yet not completely solved, but upon which progress is being made, is in the case of an altimeter which will indicate actual distances above the ground. Preliminary tests have shown it entirely practicable to measure the distance above the ground as a variable function of capacity in one of two radio circuits in an airplane. It is expected that results from a practical installation can be announced shortly.

A new altimeter standard replacing the isothermal standard has been adopted. An altimeter has been developed giving correction for ground temperature.

A new, very sensitive rate-of-climb meter has been developed.

An experimental optical drift sight, recently tested, mounted on the instrument board should be of advantage in navigation, not to mention its particular benefit in mosaic photography, bombing, and observation work.

Higher air speeds, revolutions per minute, and altitudes have necessitated the redesign of existing instruments so as to give sufficient range of scale for increased performances. In this connection might be mentioned the fact that the service-airplane instrument board is being simplified by arranging the scales in a vertical and compact set.

Under the caption of aids to navigation should be mentioned the proposed test this winter at Croydon of landing in a fog. The airplane will locate the airdrome by radio; pick the right line of approach from a leader cable; and a line of neon lights along the leader cable on the ground will show when to flatten out in gliding down by indications from the cable. Of course, stability at a low landing speed is a very necessary quality for the airplane.

Radio Beacon

The radio directing beacon located near Dayton has successfully guided airplanes and held them to within ten miles either side of the direct course, and has been heard 200 miles away and followed very successfully. The beacon periodically emits signals of two separate letters 90 deg. apart, with the course in question bisecting for this angle. The Air Mail Service has been furnished complete data on this and plans to try it out for its purpose.

A mechanism has been arranged and tested which will automatically indicate by a series of lights on the instrument board whether the pilot is on his course or not.

Electrical Equipment

With the advent of starters, night-flying equipment, and other electrical appliances, it has been necessary to consolidate electrical units, so that with the present installations that are coming out it will be very helpful even to active pilots to learn considerable about electricity.

Beacons for night flying have been improved by the introduction of a lamp-changing mechanism which automatically replaces a burned-out lamp by a new incandescent lamp, making a signal which indicates this change.

Various types of starters have been evolved to eliminate the old-fashioned method of cranking the engine by means of the propeller. There is the electric starter such as is used on automobiles. There is also the hand crank which attaches to the rear end of the engine and projects from the side of the fuselage, so geared as to reduce the effort to a minimum and yet turn the engine over sufficiently to start it. There is also a portable electric-motor starter which may be inserted in place of the hand crank. Still another type is the inertia starter. This functions by the energy stored up in a flywheel of minimum weight rotating at some 25,000 r.p.m. so as to furnish sufficient torque by its inertia to start the engine. There is still another, an electrical mechanical combination, which substitutes a small electric motor in place of the hand crank for bringing the flywheel up to speed. Just which type will survive will depend upon further developments, with reduction of weight being given considerable importance.

Skis—Wheels and Tires—Brakes

Skis have been built which allow the very efficient use of airplanes on snow and ice, and weigh approximately the same as wheels. The latest design for the de Havilland-4 airplane (Fig. 15) weighs 39 lb., the same as

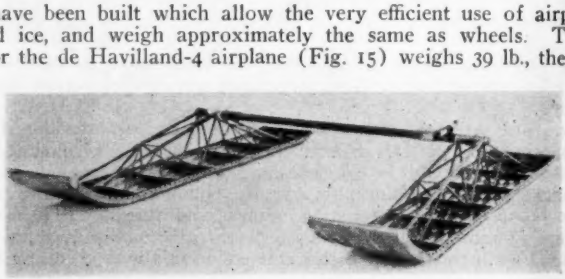


Fig. 15 A Typical Set of Metal Skis Which Compare Favorably in Weight with Wheels

the wheel weighs, giving a reduction in weight of 30 per cent over the previous one.

The Air Service is continually aiming to standardize certain interchangeable parts so as to reduce the cost of manufacture and maintenance. This is particularly true of airplane wheels and tires. Standardization is being concentrated on the straight bead replacing the old clincher type. The 28×4 straight-side wheel, drop center, is being standardized for pursuit work; two sizes of tires can be placed on this rim according to the kind of landing fields to be used. A 36×6 tire can be used as well as the 28×4. Disk wheels are being experimented upon largely because of the question of brakes for airplanes.

The advantage of being able to land an airplane and safely shorten its roll from 980 to 340 ft. is evident at the outset. This has been done with the DT-2 airplane. The brakes for each wheel are independently connected to the cockpit and will also assist in taxiing. It has been found that it is necessary to set forward the landing gear on some airplanes and also strengthen the tail skid on quite a few service ships. The use of brakes will show the greatest advantage in the case of high-speed aircraft, and may also allow designers to adopt in special cases a higher landing speed. No sooner does a scheme or device prove itself and make for an increase in the safety of aviation, than there springs up a tendency to use the improvement to effect an increase in performance. Consequently we may expect higher landing speeds. There is nothing new, of course, in brakes, but, just as with other things that have been rejected in the past, new circumstances make them feasible. This is intelligent progress.

Lighter-than-air Craft

Duralumin for the first time has been used by the Army Air Service in the construction of an airship car; in this case for one-man training airship, the TE-1, giving an estimated saving of 30 per cent in weight. A blower has been developed delivering 10,000 cu. ft. of air per min. at 1 in. of water, being twice the delivery capacity at two-thirds the weight of the lightest previous airship blower developed.

A grab winch mounted on a very maneuverable tractor has been developed to reduce the number of personnel in the ground handling of lighter-than-air craft.

The RS-1 airship, semi-rigid, 750,000 cu. ft. capacity, is now being "hangar tested" at Scott Field. Many new engineering problems had to be met in this construction. Tests with water models had been made and many engineering data obtained, and now these data are being checked against the full-scale ship. One of the main purposes of this airship is for carrying airplanes.

Conclusions

The general progress from a technical viewpoint may be considered as further refinement on work of previous years. More and more specialized engineering work is being required to carry on this advance, which, actually measured in performance and efficiency, has equaled any previous periods which might be considered. A particularly important advance was made in the second successful Army and Navy conference with manufacturers in Dayton in July for standardization purposes. Army and Navy standards are being adopted by engineering societies as standard aeronautical practice. These specifications include numberless parts such as nuts, bolts, cotter keys, pulleys, washers, shackles, hose liners, turnbuckles, hose clamps, steel wire and cable, tubing, aluminum alloys in sheets, rods, bars, tubes, and so on indefinitely.

Flying in Winter

Aviation, 8 March, 1926.—Several important decisions on winter flying were made by the pilots of the First Pursuit Group, now stationed at Selfridge Field, following the second winter maneuvers at Camp Skeel. Last year's trip to the outpost camp, which is 200 miles north of the group's base, did not result in any important discoveries, but it gave the fliers a lot of problems which they went North to solve this year and they came back with the answers tucked safely away under their helmets.

Both wheel and skii landing gear equipment had their advocates last year but this time the pilots all came back to the flying base completely decided upon the skii as best for landing on snow and ice. Experiments proved that the corrugated skiis were the best as they were stronger and considerably reduced the chance of skidding.

Temperatures as low as 20 degrees below zero were encountered and some trouble was had with the water vapor in the gasoline freezing in the carburetor. This will be solved next year by using alcohol in the fuel which will mix with any water that may be in it and prevent its freezing.

The starting of the engines, after the machines had been parked on the frozen surface of the lake all night, was rendered comparatively easy this year by the discovery of the following method by one of the mechanics:

A porous brick, that had been heated, was placed in the air intake and sprayer with ether from an unlighted blowtorch while the engine was cranked and it was usually within a few minutes that the exhausts were spitting flame even as on summer days. The oil was removed and warmed before efforts at starting were made.

Although several radiator solutions were tried out, it was decided that a mixture of alcohol and water was best suited to the cold conditions. Glycerine preparations gave trouble at those hose connections and gaskets and the mechanical force found it most difficult to seal these leaks against the glycerine. The use of grain alcohol for next winter's flying will be advised as it is said to have a lower freezing point.

Clothing for the pilots is still a problem unsolved in its entirety, and the engineering division at McCook Field will be asked to design equipment for next year's trip. Several frozen faces were listed at the camp because of leaks around the goggles. A one piece mask was found unusable as the flier's breath fogged the glasses. Warmer gloves will also be asked for next season.

The entire expedition was operated on a wartime basis and all men and supplies were transported to the camp by air. Fourteen Curtiss pursuit planes and three Douglas transports were used in the maneuvers.

Aeronautic Safety Code Approved as U. S. National Standard

Aircraft Now Have Traffic Rules, American Engineering Standards Committee.—After five years of work, a joint technical committee of fifty experts representing twenty national organizations has completed a safety code for aircraft, which includes traffic rules for the air, signals, qualifications for pilots, and regulations for the design, manufacture, testing and operation of all types of aircraft and their equipment.

This code has been given final approval by the American Engineering Standards Committee, thereby making it a national American standard.

"The value of specific regulations dealing with the various factors entering into the problem of safe aviation," it was stated by the Committee in announcing the approval of the Aeronautic Safety Code, "is shown by the fact brought out by the Department of Commerce that accidents are much greater among the so-called 'gypsy fliers' than with aviators carrying mails or working for some reputable aviation corporation. The inherent hazards of flying are in themselves sufficiently great and there is no warrant for unnecessarily subjecting pilots, passengers, and the public to hazards which can be eliminated by giving proper attention to the result of past experience and present knowledge.

"The Aeronautic Safety Code formulates the standard of good practice on which a general agreement is possible and will undoubtedly prove a valuable guide to the design, construction and operation of both airplanes and dirigibles and will form a basis for the rules of any public authority regulating air traffic that may be constituted in the future.

"The technical committee has cooperated with the International Commission for Air Navigation in order to make the code generally consistent with the International Air Convention, and with the work of the Commission, since the international aspects of aviation are bound to be of increasing importance as the art develops."

The Aeronautic Safety Code consists of the following ten parts:

1) Airplane construction.
2) Power Plant
3) Equipment, maintenance, and operation of airplanes
4) Signals
5) Airdromes
6) Traffic and pilotage rules
7) Qualifications for airmen
8) Balloons
9) Airships
10) Parachutes

Among the traffic rules are the following:

1) Aircraft meeting head on shall pass to the right of each other.
2) One aircraft overtaking another shall pass to the right.
3) An aircraft is considered in dangerous proximity to another when approaching in flight within 1500 feet.
4) Airplanes shall yield the right of way to dirigibles, and dirigibles shall yield to balloons.

The joint technical committee which drew up the code was organized under the leadership of the U. S. Bureau of Standards and the Society of Automotive Engineers. The federal government is represented on it by the War, Navy, and Post Office Departments, the Bureau of Standards, the Weather Bureau, the Forest Service and the National Advisory Committee for Aeronautics. The other thirteen participating organizations are technical and trade associations.

The chairman of the committee is H. M. Crane, Society of Automotive Engineers; vice chairman is J. H. Ames, National Advisory Committee for Aeronautics, and secretary is M. G. Lloyd, Bureau of Standards.

This committee continues in existence in order to make future revisions of the code from time to time as they may appear necessary by progress in the art or as the result of experience in applying the code in commercial aviation.

MERCHANT MARINE

Determined to Keep the Flag Afloat

The Nautical Gazette, 20 March, 1926.—Ranking Republican and Democratic members of the Senate Commerce Committee have expressed themselves with emphatic force in the matter of keeping our flag upon the sea, by the federal government itself, if necessary. This determination takes form in the approval of a $10,000,000 fighting fund to enable the Shipping Board to operate ships or lines which may have to be taken back from private operators because of "competition or other methods employed by foreign shipowners or operators." It begins to look as if the United States was determined to keep its ships at sea, under private management, if possible, but under public management if this latter condition cannot be maintained under the conditions of competition that now exist. The foreign steamship competitor who forces the private American concern to the wall will find the gap at once filled by the federal government and the flag will continue sailing until this source is also pushed to the wall. An enlightening discussion as to the future of the American Merchant Marine was carried on during the consideration of the appropriations for the Shipping Board and the Emergency Fleet Corporation. The Senate, judging by the opinion of the members of the Commerce Committee, is in a mood to back up the Shipping Board in its effort to once and for all establish the principle of American shipping in foreign trade, not as a theory, but as a fact by ships in actual operation. American ships, trading abroad, must no longer be regarded as an experiment, or an "emergency" but as a national necessity. Said Senator Jones, "I am ready to support any measure to keep America's marine on the seas. The time is fast approaching when many of the ships now operating must be replaced. If private lines cannot replace the ships then the government must provide the money for that purpose. If we do not do so we will find ourselves exactly where we were at the outbreak of the World War." The Senator, of course, refers to our tonnage, not to our investment, for the United States has spent upwards of three billions of public money and this sum must not be lost sight of in any discussion of the problem of our merchant shipping. It is still possible and it is highly probable that after another ten years have gone by the initial investment in ships, in the sudden and violent coming back to the sea,

will have handsomely repaid the country in terms of greater security, and in an annual return on a stabilized foreign commerce impossible under competitive conditions carried on in the bottoms of our principal competitors. Ships wear out but routes and trade friendships and trade conveniences and habits continue to thrive and increase from year to year calling for newer ships and better services. Much of this feeling is seen in the tone of the recent Senate discussion. No one is trying to bolster up a tottering marine, but the spirit is that of boldly determining upon a policy that will keep our shipping at sea with the good will of the government and its ultimate help if the need for this help is demanded on any route of established trade. Senator Fletcher went on record urging that the government be generous and not niggardly to the Shipping Board. He called for a larger appropriation for the regular operating fund, saying he did not want to give the board even an excuse for abandoning any of the lines now established or withdrawing any ships from operation. With Senator Ransdell of Louisiana backing Fletcher of Florida and Jones of Washington, familiar figures in the long fight for American shipping still maintain their battle in the Senate. The close touch of the Administration in the present Shipping Board situation is evidenced by the provision, relating to the $10,000,000 fund to be used in the operation of any ships turned back to the board, that expenditures under appropriation shall be made only with the direct approval of the president of the United States. Throughout the Senate discussion runs the threat of a determined intention to maintain and support the fleet until such time as the fleet will maintain itself with the help of the American shipper of commodities. As the merchant has as much power over the movement of his purchases as he has over the movement of his shipments abroad it remains for the country at large to approve and support the definite stand taken by the Senate.

Secretary Hoover States His Views on Government Shipping

The Nautical Gazette, 13 March, 1926.—The management of the government-owned merchant fleet should not be vested in the Department of Commerce, Secretary Hoover told the House Committee on Merchant Marine and Fisheries before which he appeared last Monday in connection with hearings on the several bills providing for the reorganization of the Shipping Board and the Emergency Fleet Corporation.

Mr. Hoover declared his department to be a service agency to the whole merchant marine, whether private or governmental, and told the committee he did not believe that the present form of organization handling the government fleet was ever adapted to the task.

The necessarily divergent minds of the best board in the world have always resulted in failure in executive work, he laid down. Every member must have a four-sided responsibility, being responsible for every act of the board to the country as a whole, to his particular constituency, to his political party, and finally to Congress. There is one responsibility that he does not have and that is to the President.

The President, he declared, should be vested with all administrative authority, adding that every member of the board, if he had been left alone, could probably have made a success of the merchant marine before now, but such a conception of joint and divided responsibility, even with the most consummate genius in the world at command, is the negation of possible success in business management and even of the very plan of our government that there should be single-headed responsibility in executive and administrative functions.

"In the way the Shipping Board has grown up it is today in effect solely responsible to Congress, and as a matter of fact has repudiated the authority of the President," Mr. Hoover contended. "I do not believe that Congress ever conceived it was undertaking direct responsibility for the

operation of ships, but this is the result today. It is one reason why we have made no more progress with our merchant marine than we have.

"My view is that the whole fleet and other properties should be transferred to the Fleet Corporation, the president thereof to be appointed by the President of the United States subject to confirmation by the Senate and to be solely responsible to the President. I am myself opposed to incorporating the management of the fleet in the Department of Commerce, which is a service agency to the whole merchant marine."

There are certain functions in relation to the fleet, said Mr. Hoover, which are of deliberative character, that should be conducted by some sort of board, such questions as to the inauguration of new routes or the abandonment of those being operated being of this type. He expressed himself in favor of regional representation, but warned his hearers that constructive results would not be secured or the regions properly represented if the appointments to be made were allowed to become items of political patronage. He suggested the setting up of regional committees somewhat akin to those in the Federal Reserve districts, to represent merchants, manufacturers, farmers and shipping people in that region.

For the protection of our commerce from discrimination and combinations which would impose onerous freight rates, Mr. Hoover urged that there be maintained upon each of the twenty over-seas trade routes the operation of very substantial shipping under the American flag.

"The national defense requires an American merchant marine, and it also largely requires the cargo-liner type," said Secretary Hoover. "If any type other than that of strictly commercial character is required, the extra cost of building and operating should be part of the military budget.

"We will never have a real or satisfactory merchant marine until it is owned and maintained by private enterprise. The government cannot operate cheaply. It cannot secure revenue as large as private enterprise. It cannot avoid the interminable difficulties and wastes of bureaucracy, and above all, the direct and indirect political pressures. Furthermore, government operation and competition with private enterprise with the United States Treasury as a reserve fund, totally dulls private initiative. We must get out of government operation as quickly as we can establish private operation. It is useless to renew proposals to subsidize shipping.

"Some of the government lines which are losing money today would pay private enterprise and could be disposed of under proper guaranty of continuance if private firms could be sure of future government policies. With the growth of the volume of trade most of the remainder of the lines could, I believe, be ultimately disposed of to successful private operation. Some of them could be partially assisted by interested communities. All of them would be assisted by more liberal postal rates commensurate with those paid by foreign nations.

"To our view it is vital if we are to go on, that we provide a form of administration of the government fleet that will reduce losses on those routes which the government must operate pending trade growth, and to provide methods which will facilitate these lines being disposed of to private enterprise."

Representative J. E. O'Connell, of Rhode Island, a Democrat, stated that he had been of the opinion that some sort of real government aid must be afforded the American merchant marine in order to insure its continuance. Mr. Hoover replied that it was very apparent that a general subsidy would not be legislated, but added that while there are some lines that may be found difficult to operate profitably they could be helped out by the government in a number of ways.

Other members of the committee wanted assurances that if private operators take over the lines there would be no competition from government lines.

Representative Briggs of Texas sought to make a comparison with British lines. He pointed out that out of about eighty-five cargo-carrying companies, fifty-nine lost money last year, or at least made no profit, and there were a number of companies bankrupt.

Mr. Hoover estimated that within the next twelve to eighteen months the matter of available cargo and available tonnage would be evenly balanced. The committee hearings will be resumed on Thursday next. A number of representatives of the United States Chamber of Commerce are expected to testify.

Sir Ashley Sparks Predicts Success for American Merchant Marine

The Nautical Gazette, 6 March, 1926.—Success in the opinion of shipping enterprises is a matter of slow development, Sir Ashley Sparks, resident director of the Cunard Line, told the members of the Junior Board of Trade and Transportation in an address delivered at the luncheon-meeting of the board on Thursday of last week in which he presented an analysis of the principal factors in the fundamental growth and success of a merchant marine and predicted ultimate success for the American merchant marine.

"No nation has as yet made a success at sea," Sir Ashley said, "unless or until its opportunities at home were saturated. Men do not go to sea and live in restricted quarters where there is no recreational opportunity if they can earn a living wage or have a home ashore. In fact, there is not a man afloat who after the first flush of going to sea is over would not give his ears for a good job on land.

"Again, who would risk his fortune in a hard and hazardous trade where the return is small and where he has to meet the competition and experience of the keyed-up surplus population and money of other saturated nations if he could enjoy his funds more safely and profitably at home?

"It has been so through the ages, the Greeks, the Carthaginians, the Phoenicians, the Spaniards, Scandinavians, Dutchmen, the British, Germans and Japanese all achieved their success at sea because their populations and capital overfilled the opportunities in their own lands.

"In the days of the clipper ship America had a signal success at sea. What brought it to an end? The building of the transcontinental railroads, which opened up the country and multiplied a thousand times the opportunities at home. America in those days consisted of a narrow strip of coastline, and the building of the railways opened up an immense hinterland, which has resulted in the building of great cities, great enterprises and opportunities by the hundreds of thousands for men to prosper and live normal lives in their own element.

"Again, the fleets of nations have been built up gradually ship by ship. For example, a man in Bergen or Rotterdam, or Sunderland, who, let us say, earned his living generally, and had vast experience with freights, operating costs, etc., decides to become an owner, and employ his accumulated savings in the business he knows best, so he goes to a few friends and proposes to them that they shall take a share in the venture.

"The ship is built, she runs for a year or two, and perhaps if she was born into a world fit to receive her, that is, into a fairly good freight market, she makes a little money and the owner again goes to his friends, they put up their profits and some more thousands of pounds, and they build ship number two. So, over the years, a fleet of five or six boats is built, the personnel in experience in building and operating them, is growing side by side with the growing enterprise, and it is of units like this, that a national merchant marine is created.

"Against this, your own national effort is of ships created almost over night as a war necessity, and carried on afterwards as a matter of national pride with none of the slowly matured private initiative to lean on, and very few, if any, of the necessities existing that drive a nation to seek its fortune at sea.

"Furthermore, added to the great handicap of government ownership and operation, your effort has been made when international trade is handicapped by depreciated currencies in many parts of the world, and an almost world-wide nationalistic spirit, a natural outgrowth of the war, which says in effect, China for the Chinese, a Patagonia for the Patagonians and America for the hundred-percenters. Under this policy nations attempt to raise barriers against the normal flow of goods and peoples, not a very encouraging atmosphere for a great effort at international transportation to flourish in.

"I have in mind such political phenomena as extravagantly high tariff barriers, immigration restriction acts, in various parts of the world, laws that confine nationals leaving their country to national flagships, coastwise laws that restrict transportation between ports of a country to ships of that nation, and other matters all restricting the natural ebb and flow of peoples and goods.

"Do not think that I am criticizing such acts or policies. Those enacting them claim them as necessary to their nation's welfare, or at least think they are, but I am just pointing out to you the actually existing handicaps through your country's effort at sea.

"It is a phase and it will pass, but you who represent young America, might remember some of these things when this great effort of yours is subject to unthinking and uniformed criticism. That it will succeed, at any rate in such part as is fundamentally warranted, I am certain."

Boats (Captain Felix Riesenberg in the Rough Log Column)

The Nautical Gazette, 6 February, 1926.—The Atlantic, in the past month, has given a taste of weather to the readers of newspapers. One winter is about like another to the seaman crossing the Western Ocean. Only when a vessel sinks, and they continue to founder with alarming regularity, does the public hear of the whole gales and storms that habitually sweep over the northern seas at this season. Two outstanding rescues, darkened by tragedy both on the part of the victims and the heroic seamen who attempted rescue, hold our attention. What I marvel at is the fact that any rescue was possible at all, when the usual type of ship's boat, carried by modern merchantmen, is considered.

The steamship *Bremen* of the N.G.L., Captain Wurpf, took six men from the foundering British steamship *Laristan*. Then the seas became so high further boat work was impossible and according to present accounts the freighter sank with her remaining hands—some twenty-five men.

The steamship *President Roosevelt*, United States Lines, Captain Fried, after many attempts and the loss of two men, and *five boats*, took twenty-five men from the sinking steamship *Antinoe*, also British. The foundering craft apparently was unable to launch boats.

I have long advocated better small boats for merchant craft. At least two boats, whalers preferred, capable of being handled in high seas, with a steering sweep, and of sailing, has been my pet idea for merchant craft of all kinds.

Anyone who knows anything about small boats must marvel at the mind that supplies boats, pointed at both ends, high sided, double banked, and bulky, for work at sea. Such boats, designed to carry a maximum number of passengers *in a smooth sea*, answer certain standard requirements set down by various governments. As ships generally founder in

very heavy weather, the whole object of boat equipment seems to be to only comply with the letter of the regulations.

Of course, the better class of liners carry quarter boats, but these are not always the best form for heavy weather. What should be carried by every seagoing craft are two whalers of the Nantucket type, boats with a strong sheer, six-oared, single banked, and fitted with a long steering sweep. These boats should also carry masts, and lug or sprit sails, and a centerboard or keel.

The management of steamships has become such a grind, little or no attention is given to the quality of the crew. With good boats, and the encouragement of the owners, crews, at odd times in port, on company's time and on their own time, should be allowed to practice sailing and pulling. By making a sport of the thing, which it is, the use of boats under extraordinary conditions would find men trained and ready for the job.

A whaler will live in practically any sea. The boats are as near unsinkable as anything that floats. They lie low in the water, in a great gale the wind can't get hold of them, and the long, flexible ash oars make it possible to handle them with speed and safety. An able whaler, in addition to her crew, can take on board from ten to twenty people without undue overloading.

Such whaleboats should be free of the great amount of junk now piled into lifeboats, according to law. Whale boats won't sink, as they are made of wood, and the loads of provisions, etc., should be left on deck handy in case the boat is needed in abandoning ship. Other boats, the burden-carrying kind, would of course be carried, but even these might be better designed for living in sea.

Both the *Antinoe* and the *Laristan* would have been among the great list of missing craft if it had not been for the radio. For a time the *expense* of fitting radio equipment kept many vessels from carrying such apparatus. Now all ships carry radio and the lives and property saved through radio has proved the thing a good investment. In 1924 Senator Marconi told me that, in his estimation, at least a hundred thousand lives had been saved at sea because of the radio equipment of vessels. The list is growing day by day.

Some enterprising lifeboat maker should build a seagoing lifeboat, capable of being handled in any weather, the cost would probably be less than that of the present clumsy boats supplied. Then the laws regulating these matters should call for the carrying of such boats.

Boat practice is something only possible where men have the encouragement and the opportunity to use boats *for sport*. The perfunctory lowering of boats, in harbor, is about as useless as reading a set of directions for rowing. Men who never get off the high topsides of a steamer are clumsy and afraid when they are called upon to man boats. And here it might be just as well to say that the men who are most timid about the matter are probably the most courageous, for they go into rescue work with the fear of failure. And the story of the last winter shows that courage is not lacking in the men who now go down to the sea on ships.

One of the finest things about our schoolships is the familiarity gained in the handling of small boats. This is also the great asset of the men who start their seagoing as fishermen or in the Navy. They are able and experienced in the handling of boats, and the close proximity of the surface of the sea fails to frighten them. As everyone knows, who has been afloat in heavy weather in a small boat, the surface of the water is less windy than the air some ten feet above the surface. The wind is broken by the water, and this broken water is also capable of modification by the use of oil.

Perhaps if all ships' crews, of all nations in sea competition, were carried under a compulsory insurance, paid by the ship, the matter of

boats would receive careful consideration. It is something the next International Conference should look into.

The Sea as a Career (By Captain Felix Riesenberg).

The Nautical Gazette, 27 February, 1926.—What has recently happened on the *President Roosevelt* and on the *President Harding*, and on a number of other fine ships, has done more to elevate the sea service in terms of public respect than oceans of talk and tons of print.

What business ashore makes it possible for men to do heroic deeds and win great honors? Few, if any, is the answer. What business carries with it the great benefits of world travel, and association with foreign people? The advantages of a sea career are so many it seems strange that the business of shipping is left to the few boys who literally have to force themselves into it.

Going to sea should be one of the preferred callings. It is a gentleman's job in many ways. Lots of hard work, to begin with, but many compensations in the end.

The British have found out the advantages of keeping their young men at sea, and the class of youngsters going to sea is a credit to the shipping. Go on board the average British ship and talk with the junior officers. You meet the kind of men found on a college campus in America, only there are liable to be a bit more hardy and somewhat more tolerant and well informed.

Our boys, after high school or college, get into the frothy work of life—selling, advertising, banking and allied fields. If the sea service was better organized and better understood the pick of our young men would be at sea and the left-overs would be ashore hitting the selling trail, running around with samples, in bags, or easing by the daily time clock to the stationery desk.

With a lot of Americans at sea we would gradually get a lot of American seagoing executives ashore and would develop a very strong force of men with an understanding of foreign conditions and foreign trade.

The sea service, both on deck and in the engine room, offers a great opportunity to the young man today. The getting of our young men to sea, to stay, offers another great opportunity to those who own shipping property and who have a permanent interest in the extension and development of our foreign commerce.

Seagoing engineers are at a premium ashore, and when the value of sea discipline is better understood, seagoing executives will also be at a premium in our commercial working organizations.

RADIO

Rivalry Between the Nations in Wireless Expansion

By William H. Scheifley, A Member of the Faculty of Indiana University

Current History, March, 1926.—If a nation would today enjoy security and prosperity it should possess its own radio communications with the outside world. The experience of recent years has made clear the necessity of such utilities for assuring a country's independence and for facilitating its intercourse, both commercial and intellectual, with other countries. Hence the scramble among the nations of late for priority in the establishment of wireless plants throughout the world. Especially has France made great strides forward, although impeded by serious handicaps. She has won a creditable rank in the movement, thanks to the excellence of her radio equipment.

It behooves the French the more to safeguard their radio interests, since they were largely dependent upon foreign companies for international cable communications, a deficiency that extended back many years. In

contrast with Great Britain and the United States, France has had no consistent cable policy. Consequently, of more than 800,000 miles of submarine cables used for the transmission of international dispatches, the French own but 20,400 miles, or 7 per cent. Only three of the seventeen foreign cables touching Europe belong to them. Aside from North America, their cable communications with other countries are chiefly effected over foreign-owned lines. And if from the standpoint of length we turn to the volume of cable transmission France's share appears as more insignificant still, since it represents less than 3 per cent of the total receipts. In other words, Great Britain and the United States, which control most cable lines, share between them nearly 90 per cent, of such revenues, amounting to about $75,000,000 each year.

The disadvantages of such a situation as that of France are obvious. To be dependent upon foreign utilities, either politically or commercially, limits a nation's liberty of action. Thus, in nearly all parts of the world dispatches from French sources are received after those from British or American sources have been circulated. Similarly, the French often are handicapped in commerce by the fact that earlier reports have enabled their competitors to skim the cream from the world's markets. As economists point out, a people's opportunities in matters political, commercial, and financial are, so to speak, proportionate to its ownership of international communications. Some have wondered why the French did not expend their foreign cable lines after the World War. That was financially impossible, since, for example, the construction of a double cable from Europe to the Far East would cost at present 600,000,000 francs.

Wireless telegraphy fortunately offered the French a less expensive means of communicating with other countries. This was in line with the growing possibilities of radio transmission. Three years ago Newcomb Carlton, President of the Western Union, the largest American cable company, stated that the trans-Atlantic radio service could send half the messages handled by the seventeen existing cables. At the international telegraph conference in Paris, in September, 1925, Senator Marconi pointed out the unique part played by wireless in recent years. He mentioned particularly its services in the World War, in lessening the perils of navigation, in safeguarding life at sea, and in furthering air traffic. Nor did he fail to emphasize the importance of radio as a medium for disseminating instruction and amusements. In Marconi's opinion, finally, the extension of wireless telegraphy bids fair shortly to cause substantial reductions in cable rates.

In the radio field, however, as in that of the submarine cable, the French, at the end of the late war, found themselves out-distanced by other nations. The Marconi organization, which held a monopoly in Great Britain, operated stations at Clifden, Pollhu, and Carnavon. Besides, this company had secured extensive concessions in Canada, South Africa, Spain, Brazil, and Colombia. In 1921 it signed an important contract with Switzerland, and seemed destined to acquire exclusive radio rights in India. Everywhere its expansion progressed methodically, threatening to envelop the world with a network of wireless telegraphy under British control.

Nor was the powerful British syndicate the only one to be feared by the French. On this side of the Atlantic the Radio Corporation of America, which had been founded at the request of the United States Government, had established relations with Great Britain, Germany, Norway, Italy, Hawaii, Japan, and Central America. By virtue of its exceptional privileges, this corporation in the words of its President, "sought to organize radio communications, exploited and controlled by America, for the purpose of competing with other nations and of freeing America from dependence upon foreign-owned cables." Accordingly, the United States

Government transferred to the syndicate the radio stations it had used before and during the World War, and by an act of Congress of June 5, 1920, the American Radio Corporation reecived further exclusive rights.

As for Germany, she manifested the greater activity in the wireless field since it offered her the only way to obtain rapid compensation for her loss of submarine cables during the World War. Here again there sprang up on enterprising company, the Transradiotelefunkengesellschaft. Backed by the German Government, this syndicate hastened to connect its installations at Nauen with the United States, South America, and the Far East. Its plant at Eilvese took charge of communications with Spain and Czechoslovakia. At Batavia, Java, the German firm had constructed a powerful Dutch station, which served as a relay between Nauen and points in the Pacific Ocean. It enjoyed a privileged position in Holland and had obtained from Argentina the concession for a plant at Buenos Aires.

Such, then, was the situation: three puissant foreign syndicates, backed by their governments and favored with extensive concessions abroad, were rapidly monopolizing international wireless communication. A contest was already under way in Brazil, Argentina, Venezuela, Chile, Peru, Ecuador, Mexico, Italy, Servia, Greece and Poland. And one was opening in the Far East, where rivalry between Great Britain and the United States gave promise of a spirited struggle.

The French, engrossed in problems of reconstruction and financial difficulties, had deferred participation in the radio scramble. But soon it became apparent that they must act with redoubled efforts if they wanted "a place in the sun." Although the French Government seemed disinclined to alienate its wireless monopoly, it had no alternative. Besides, had not other countries granted such rights to a syndicate? Accordingly, in October, 1920, France authorized the formation of a similar syndicate, called the Compagnie Generale de Telegraphie sans fil. So there finally existed in France a definite corporation qualified to negotiate radio concessions in foreign countries. The company's first step was to let a contract for the construction of a superstation at Sainte-Assise, near Paris. Eighteen months later that station opened communication with America. Its power and rapidity of transmission were unequaled in the world. Nor to this day, it seems, has any other attained its technical excellence. In consequence the French syndicate was henceforth prepared to compete for the establishment of wireless communications over the world.

In 1921 the Compagnie Generale secured permission to do business in Argentina, where the German, American, and British syndicates had already opened offices and were about to divide the radio industry among them. Thanks, however, to an eleventh-hour effort of the French company, it obtained an equal share; and since July, 1924, the director of the quadruple corporation of Argentina has been a Frenchman. In Brazil the Compagnie Generale secured a similar right of participation a principle since applicable to virtually all South America. Further, in Czechosovakia it erected for the government a wireless station destined to connect that country with the plants of Europe, and, through the powerful French station at Sainte-Assise, with those beyond the Atlantic.

In Rumania the French syndicate supplied the materials for the Bucharest station and installed them. In Yogoslavia it constructed the central plant at Belgrade and won the concession for the entire country. In Belgium it erected the gigantic station at Ruysselede. It installed the wireless plant at Beirut in Syria, creating at the same time the Oriental Radio Company.

In China, where, due to the extent of the country and the density of its population, a bright future awaits wireless telegraphy, important concessions have recently gone to the French company. This seems surprising, since China had signed contracts with other syndicates long before the

French appeared on the scene. For example, in 1913, the associated cable companies known as the Eastern Extension and the Great Northern had obtained from the Chinese Government for seventeen years a monopoly of cable communications between that country and the outside world. In 1918 the Japanese Mitsui syndicate had secured a like monopoly of Chinese wireless for thirty years, on condition that it reached an understanding until 1930 with the cable firms just mentioned. Yet, such contracts did not prevent the Marconi syndicate from creating the Chinese National Wireless, a corporation to which the Chinese Government granted preferential rights in contracts for radio supplies. Furthermore, in 1921, the Federal Telegraph Company of San Francisco was commissioned by China to construct a powerful radio station at Shanghai and four smaller ones in other parts of the country. Finally, China had conceded to the Western Electric, another American cooperation, its domestic telephone service.

When the question of wireless in Eastern Asia and in the Pacific came up for discussion at the Washington Conference of 1922, France had received nothing. But the conference agreed that henceforth the French should participate on a footing of equality with the nations which had already secured concessions in the territories under consideration. As has been pointed out by Emile Girardeau, the French technical expert at the conference, this success well merited the congratulations which it evoked from the French Cabinet of the time. Since then, in fact, France has shared in such Chinese concessions.

In Russia, where France had acquired a preponderant economic position before the World War, the Soviet Government has of late striven to safeguard its interests. In radio matters these efforts have been crowned with success. Three years after the armistice the Soviet Government approved an agreement consolidating the interests of the French Compagnie Generale and the Russian Electro-technical Trust.

Nor did the foreign expansion of the Compagnie Generale end with Russia. Owing to its capital and its technical resources, the Italian Radio Company was created in Italy, where the two syndicates have collaborated in the construction of various wireless stations. Moreover, Turkey quite recently awarded to the French a far-reaching contract for wireless installations, the first centers chosen being Contantinople and Angora.

Such are some of the outstanding achievements of France's wireless organizers and engineers operating abroad. Despite the keen competition of foreign syndicates having at their disposal unlimited capital, the French have in the last five years constructed nearly 50 per cent of the world's larger radio stations. The results speak well for their science which, although lacking costly equipment, has maintained the prestige of France in foreign countries, thanks partly to the researches of her radio specialists like Branley and Ferrie.

Yet, the strides of the French in this direction have not made them covet a monopoly of the world's radio installations. Rather do they regard the marvelous possibilities of wireless as offering perhaps the most potent influence working for peace among the nations. Thus the French weekly review, *L'Europe Nouvelle,* recently declared editorially that no nation should presume to acquire a monopoly of wireless telegraphy and telephony. On the contrary, all collectivities and all countries ought to develop this marvelous method of transmitting thought, which recognizes no frontiers traced with human blood. According to the same editorial, the Hertzian waves foster a solidarity that leaves no excuse for ignoring the progress of mankind. Perhaps the nation that first comes to realize the universality of wireless telegraphy for the purposes of instruction and amusement will be the first to disseminate in the world its thought and genius.

MISCELLANEOUS

In a German Airship over England

A Story of the Raid of 19th-20th October, 1917, *Journal of the Royal United Service Institution*.—February, 1926.—NOTE.—On the night of 19th-20th October, 1917, it will be remembered, eleven German airships attempted a serious bombing attack on the industrial centers of the English Midlands—London was not the objective. Owing to lack of meteorological data no warning was received of the heavy northerly gale which set in above 14,000 feet on that afternoon. The velocity of this fierce air-current at one time exceeded 70 f.s.

Caught in this storm the German airships were swept southwards and, in struggling to get home, found themselves over France. Five were lost—*L-49* landed in Eastern France and surrendered; *L-50* made an emergency landing near *L-49*, tearing away the forward car, from which all but four of the crew landed, and then rebounded and was driven South and finally lost in the Mediterranean; *L-44* was shot down and burnt at St. Clement; *L-55* was wrecked in the Thuringen Forest after reaching Germany; *L-45*, the subject of this narrative, landed in Provence.

The following account has come to hand from a foreign source. It is that of one of the helmsmen of *L-45*. The man's story has been translated and checked by two of the actual officers who were working on this subject during the Great War: the facts may, therefore, be assumed to be substantially correct.—ED.

"You ask me whether I do not regret my life and my work in the German Naval Airship Squadron. Well! I can only reply that, since the war came to an end, I have never felt the slightest desire to go up in the air, either in an airship or in an airplane! I served for over two years with our airships and, while the war lasted, there was no man in our service more zealous or more willing to make a war flight than myself. But on thinking it over during the past year I know and feel that I have had enough of the air. The risks we ran were never properly appreciated in our own country. The thanks we received were small enough. We were ever abused for not doing our share against England. The earlier stories of huge damage that our raids on England were believed to have accomplished, all these were swallowed by the German public, until it would have been impossible for our commanders to return without tales of having repeated such exploits. Yet those of us who steered the airships over England had had every opportunity of judging how uncertain were our commanders as to their courses and the effect of our bombs. Many a time I had heard them—the commander himself and his watch officer or his warrant officer—wondering were they over England! As I was at the wheel I knew as well as they did of their uncertainty! There was only one airship commander with whom I ever flew that I would have trusted to find his way over England without making a bad mistake. That was Heinrich Mathy. What a man he was! And his crew—the best that ever mounted into an airship. But even Mathy sailed over England chiefly in 1915, when navigation was easier and the enemy airplanes were hardly in existence! It was indeed luck that in 1916 I twice sailed with him as second steersman when that ordinary member of his crew was on leave. When Mathy was brought down at London[1] the greatest gloom overcame the Airship Service. It was in fact the end of our great hopes that we should force the English to make peace by bombing London with the new big airships that were first built in 1916. Mathy was given the command of the first of these (*L-31*). What a wonder he was! He laughed at the greatly improved English gunfire and his crew would

[1] Mathy was commanding *L-31* when that ship was brought down by Lieutenant Tempest, R.F.C., near Potters Bar in October, 1916.

tell how he would slow down his ship and deride the English gunners to hit him as he flew over London. It was a wonderful tale that his crew would bring back.[1]

It was the airplane firing the incendiary bullet that brought about his downfall and with him the life and soul of our airship service went out too. We still flew; our ships were mostly quite well commanded, but it was never the same again! I for one was lucky, for I found myself at the end of 1916 allotted to the crew of one Waldemarkölle, a brave commander, and a pleasant gentleman to deal with though a hard man and harsh in manners. But to compare even him with Mathy; no, that would be doing an injustice to the best and most skillful officer our service ever possessed—or could wish to possess.

After Mathy's death we never did so much raiding as of old. It was thought, first of all, that we must improve our airships. The new ships of 1916 had been defeated, not by guns—we used to laugh at them—but by our own gas. The terrible hydrogen! Had it not been for the gas, Mathy would not have died! How many ships did we not lose through the gas? I myself in my service have counted three airships alight, and I know that more than twice that number have been destroyed by the fire of their own gas over our own country alone. They used to try and hide it from us, but how could they? These things did not happen unseen, and, we of the airship service, we always knew where our comrades were and how they fared.

So it came about that because the gas was still there and still inflammable as ever, they tried to make the airships even lighter and lighter, so as to go so high as to be unseen and unattainable by that invention of the devil, the incendiary bullet. Had we caught the man who invented that bullet during the war we should gladly have burnt him on the great flying ground at Ahlborn[2] in a stream of blazing hydrogen. How many of my friends have not perished through his infernal invention?

In 1917 some beautiful new airships were completed at Friedrichshaften. They were indeed marvellous! We, that is Kölle and his crew, were allotted to *L-45*, a great change after our old wooden-framed Schütte-Lanz. We, who had known the ships of 1915 and of 1916, were astounded at the new ship. Everything was so perfectly contrived to save weight, while the ship itself was even bigger, even though it had grown lighter and so rose higher. The cars were smaller, it is true; we were more crowded; our rest quarters had been suppressed; machine guns had gone so as to reduce all weight. Height and speed, we were told, would be our true defence. Six thousand metres[3] would be easily attained and no English gun or airplane, it was stated by our officers, could touch us at that height. Alas! Our hopes were not to be fulfilled so literally as that. It is true that the guns seemed powerless and the searchlights were no longer so much to be feared, for the news ships were painted black underneath. They became virtually invisible from the ground about 6,000 metres.[4]

During 1917 several improvements were carried out on the new ships: they were to be made even lighter before embarking on a new series of raids against England as the weather improved. The cars were made still smaller. The wing propellors were done away with, until we could hardly recognize our engine cars.

It was assuredly not all pleasure to serve the engines in so crowded a

[1] There is reason to accept the statement that Mathy once (September, 1916) stopped his ship over London, and once (1916), drifted over London on a strong southerly breeze with his engines shut off.

[2] The principal airship station of Germany in 1917.

[3] About 20,000 feet.

[4] Perhaps not absolutely true; this depends on the power of the light.

space. The ladders leading into the wing cars were fearful things to ascend or descend in a gale and during frost. Still we put up with these discomforts for we thought that we should now be safe, so the engineers, huddled close to their engines, and went on contentedly in that belief. But we steersmen, who could see and could hear our officers and warrant officers, soon began to have some doubts. Navigation, too, grew more difficult at such heights.

What, however, brought consternation to some of us was the effect of the height; and not only the actual height but also of the rate of ascent. It was soon found during the actual height trials of the new ships that the strain exerted by their terrific ascending power was greater than many of us could stand. Height-sickness, nausea, giddiness, we nearly all suffered from it or them, in some form or another. The older men felt it more than the other younger ones. One comrade of mine—not in my own ship fortunately—died from heart failure during his first height trial and the ship had to come down. I myself, and many others, soon grew accustomed to the changes of altitude, but the process of climbing often left me somewhat slow of hearing and my work grew heavy as the navigator who had to share my duty at the wheel did not take to the new ship at all well. So I often did more than my own turn for I felt sorry for the poor fellow; he had always been kind to me and he was grateful, too, for my lightening his task.

Then there was another trial—the cold. That was far worse than the height in its effects. The engine ratings were not so badly off; they at any rate could feel the warmth of the engine while we, poor devils, in the forward car, with the first no means of heating ourselves, suffered terribly. It was all very well for the short trips, that lasted only two or three, or even six hours at a high altitude. That was play compared to the long flights that now fell to our lot. Cold and height went together—often even in the summer nights when these were short and the days had been hot. But in the autumn things were to grow worse. By a stroke of devilish mischance our new ship, *L-48*, somehow or another never returned from a raid over England during that summer and we never found out what had happened to her. It was a great blow to our officers, that loss! It was worse still, as the commander of the Western Naval Airships, Kapitän Viktor Schütze, was on board. Now, he was a bold, skilful officer and we knew full well that he would never have flown low or skirted the cold. It was said, with truth, I believe, that he had purposely flown on that English raid in order to test the capacity of the new ships. But it was also rumored, whether true or not I cannot say, that he had also gone on that ship as her commander had been suspected of the worst crime that a German Naval officer could commit—not carrying out his orders for reasons of fear. It was the English airplanes.[1]

Anyhow, this disaster had grave consequences—at least so we decided later. Our new airships were no longer trusted as they had been before; our commanders were undoubtedly shaken in their belief in the possibility of escaping the airplanes by means of the climbing powers of their craft. So they sought to go still higher up and we suffered still more from height and yet still more from the cold as the summer days grew shorter.

Well, so it was more and more evident to some of us that things were ripening for trouble. Engine breakdowns grew more frequent as the cold grew more bitter. A few of our best and oldest warrant officers were asking to go back to fleet work or anything to escape the trials of these flights under the new conditions. For a raid on England was becoming a serious under-

[1] *L-48* was brought down by British airplanes at Theberton in Suffolk on 17th June. Two of her engines went out of action and she had become virtually unmanageable at the time.

taking. In former days December flying over the North Sea with Mathy at 600 metres (2,000 feet) on a warm night, with resting quarters available in the ship; this could be no great hardship. But now our commanders would start at 3,000 metres (10,000 feet) as soon as they were clear of land. Then, as soon as England was made, they would go 4,000 or 5,000 metres (13,000 to 17,000 feet), with the expectation of climbing to even greater heights if attacked by airplanes aided by searchlights from the ground. Twenty hours of this ordeal would bring me home exhausted, deaf, and sometimes giddy. For two days afterwards I was good for nothing, and our seaplane pilots at Borkum would laugh at us—that hurt! For those fine gentlemen did not know what it means to do twenty hours at those heights, at night and in that cold. What did they know about it, they who could remain out for less than six hours and that too at never more than 3,000 metres.[1]

Our commander, Kölle, however, was not to be deterred. He weeded the weaklings out of his crew and he still further tried to lighten his ship by leaving out our relief numbers. On one occasion he flew his ship to England with only fourteen men besides himself. This nearly brought him disaster. One engineer went sick, neglected his engine, which soon froze and we came home—by a mere fluke so I shall always think. Had it been really cold we should have come utterly to grief. The matter came to light and Kölle "got a black cigar"[2] from the commander of the airships at Nordbolz. Orders were also issued by him that no car was to be manned by less than one rating during any height trial or any war flight. Kölle grumbled, it is true, but he was a bit scared by his own temerity and he was not bold enough to attempt it again.

It was under these conditions that in the middle of October preparations were begun for what was to be a big raid on England. We all knew there was something coming off, although we were not told. The ship was overhauled and filled. Kölle had shipped but a light load of bombs; he left one steersman and the relief telegraphist behind. His face showed that he meant business. We looked anxiously at the clouds and wind, for we fully realized that we would fly high and long. That meant cold! Kölle's own hip pocket was bulging with a packet of food and we had all done the same.

On October 19 the final orders came and we left our shed[3] at half-past eleven. The journey over the sea was cold and misty. We barely sighted some of the other airships off the Frisian coast. There were at least twelve ships under orders to attack England, so I understood Kölle to tell the navigator, and from the radios that were taken on board I think they all must have started. We did not see them at all clearly, for it was the custom to fly independently while keeping a general direction. Once started the radio gave us little news. Once or twice we thought we saw another ship; *L-54* we recognized by the setting of her cars; *L-47* we distinguished through the glasses. Then I heard Kölle identify *L-50*, so it seemed to him, and he passed some disparaging remark about her commander for he despised his skill as an airman no less than he suspected his determination. *L-49* we thought we recognized, or so the navigator said, by her little flag that she flew from her forward car.[4] But it was a dreary, windy crossing

[1] 10,000 feet—a slight exaggeration.
[2] A "severe wigging."
[3] *L-45* was stationed at Tondern in Schleswig.
[4] This flag was a purple square decorated with the armorial bearings of her Commander Gayers. He used to fly this flag for the benefit of his family, who lived near the coast and could see the airships daily. By means of this flag they could recognize *L-49*. The flag subsequently captured with *L-49* was hung in the office of the French Secretary of Aviation in Paris, where some fanciful stories were wont to be told as to its significance.

and owing to the cold and height many of us were feeling numbed and slack by the time we made the English coast at about 8:00 P.M. We could not be sure of our landfall as it was dark and our navigation was undoubtedly at fault. We should, so I believe, have crossed the Lincoln coast; but from an argument we had with the officers our navigating warrant officer, Hashagen, expressed grave doubts as to the landfall. I felt sure we were a long way south of that. Kölle, however, though looking anxious would not give way. I looked at my comrades in the car to see if I could read their thoughts, but only cold and anxiety were there. The wind must have freshened from the north for even then, like the lightning, some searchlights cut the air; all I could see by their warm beams was the leeway that we were making. Kölle swore and jumped at the ballast control cords. The ship rose rapidly. "5,800."[1] read Hashagen off the altimeter; the height and the cold made him look ghastly in the pale searchlight beam as he leant on the glass panels. I shall never forget his face. I felt, too, that I would get little sympathy from him, if I dropped out, for the height and anxiety were telling on him already. Guns opened on us too, but that did not trouble us.

For nearly two hours more we struggled to keep our westward course but the wind blew ever stronger and I could tell that our navigation was getting more and more uncertain. We dropped a few bombs at some faint lights but providence alone knows where they went. I scarcely believe that Lieutenant Schütz, our second-in-command, even troubled to set the bombing sight.

By this time it was bitterly cold. Hashagen once read the thermometer should and gave over 30 degrees of frost.[2] I heard him mention Birmingham as our target but he did not believe we had reached that locality. We climbed still higher as the weight of the bombs and petrol grew smaller and it grew still colder. Hahndorf, an engineer, now came in to report to Kölle that the men were feeling the cold. The sailmaker, in particular, who was attending to the valves of the gas bags, complained of his feet. Well he might do so, for he could not wear his felt boots when climbing about the ship. He said he could not go on much longer. Two engineers, so Hahndorf said, were sleepy; while the petrol rating was grumbling and fumbling over his work.

Something must be done. The wind was rendering our progress westwards laborious. It was clear to us who had no say in the matter, that we ought to turn back, yet Kölle would not give in. The navigator and director began to express misgivings. Finally, Hahndorf re-appeared and gave his opinion that that his engines could not be trusted to go on much longer under such conditions. Reluctantly Kölle gave the order to turn; it was now 11 o'clock. Hurriedly he gave his instructions for the return overland—over Belgium. This was a bad sign, for it was not a step that our airship commanders would do unless the weather or other conditions were threatening. I could tell by the compass that we were now steering south-eastwards. The wind must have increased in violence and the cold was the worst I have ever experienced; I could scarcely continue, in spite of all felt boots and quilted clothing, it was terrible. It grew too cold to pull out the food to eat; the meat that one man pulled out was hard as stone. Kölle clearly not knowing where he was let out more ballast; we must have touched 6,500 metres or more.[3]

At about 11:30 we began to see lights below and as the lights continued so it suddenly dawned upon us that it could only be the city of London that we were crossing in the air. Even Kölle looked amazed at the dim lights

[1] 19,000 feet.
[2] Centigrade—about 60°F.
[3] 21,000 feet or over.

as Schütz suddenly shouted "London!" It was then that we first realized the fury of the savage tempest that had been driving us out of our course. But Kölle clearly had but one thought—that was higher. So he released more ballast and the bombs—first two sighting shots and then the rest. Over London! We had achieved what no other German airship had done since Mathy had bombed that proud city over a year ago! And his last trip across the city had proved his undoing.[1] Fortunately for us we were unseen; not a searchlight was unmasked; not a shot was fired; not an airplane was seen. If the gale had driven us out of our course, it had also defeated the flying defenses of the city! It was misty or so it seemed, for we were above a thin veil of cloud. The Thames we just dimly saw from the outline of the lights; two great railway stations, I thought I saw, but the speed of the ship running almost before the gale was such that we could not distinguish much. We were half frozen, too, and the excitement was great. It was all over in a flash. The last big bomb was gone and we were once more over the darkness and rushing onwards.

It was then that our misfortunes began. Hahndorf reported to Kölle that the engine of the port wing car was scarcely working—he thought owing to the sooting of the plugs. The plugs were cleaned by the engineers but alas! their hands were so cold and they themselves so clumsy with lassitude and fatigue owing to the height that, by the time the plugs were cleaned and replaced, the engine had ceased to function—the cooling water had frozen; the radiator[2] had split and there was no means in our power to get the engine into action again.

From this moment our journey became one long story of misery and pain. The cold grew intense and we all began to feel dejected at the consciousness that our real attack on England must have failed. The jubilation at having flown over the enemy's capital gave way to anxiety. At the helm of the ship we began to feel that the gale was driving us away, still further out of our course. We were so high that the earth was scarcely visible. Clouds were obviously being driven beneath us until we could not distinguish the sea. It was somewhere after midnight that Hahndorf came to report to the commander that the sailmaker could scarcely go on with his duties; his feet were frostbitten and the poor fellow was now lying in his hammock unable to do more. The petrol rating was complaining of weariness and sickness, leaning up against his tanks. Two engineers were suffering from height; one of these had been relieved by the man from the port wing car. Kölle became visibly perturbed! Even Schütz, usually so cheerful, looked pale and anxious. So we went on in gloomy silence.

For some two or three hours—we hardly knew how the time went by—we drove on, but, as events showed later, our course was now pure guess work. When and where we crossed the sea we could not tell. Hashagen argued we were now steering over Belgium, but somehow his voice lacked conviction. Kölle uttered not a word. We well knew that he was more than uneasy. The want of our port propeller told on the steering and I myself feared that this would endanger our safe return to Germany.

The hours dragged on. The petrol rating was now really ill. Both ratings from the port wing car were now relieving other sufferers. Hahndorf was growing anxious about his fuel supply and said so. Kölle stormed at him. But the man's worn, pale face and his frozen black moustache and beard deserved only pity. He was gallantly struggling against sickness.

At last dawn began to light up the sky. One, and then another, airship were barely distinguished against the eastern light. They could only be

[1] Mathy never crossed London on this last raid (1st October, 1916); he was brought down before flying over the Metropolis.

[2] This was of a new pattern, which could be raised or lowered out of the car by a winch. It was then right down.

German, but we dared not use our radio, and that in itself was proof that we might be over the enemy's air defenses. Kölle rapped out a bitter exclamation as this suspicion grew into certainty; flashes on the ground showed hostile gunfire to be at work; whether shooting at us or not we could not tell. We saw no bursts. Still more, to our intense relief, we never sighted an airplane. Schütz assumed a reassuring tone, but this was abruptly checked when we felt the forward engine behind us slowing down and finally stop! Hahndorf came in; he was almost breaking down. The petrol supply for the forward engine had given out and the radiator, as the engine ceased running, had frozen solid.

With this accident our hopes of reaching home decreased greatly. Yet somehow we could not realize it or else Kölle had succeeded in making us believe that things were better than they were. This failure of the engine, directly occasioned by the illness of the petrol rating, was the outcome of a bad leakage in a union of the feed pipe. It had occasioned the entire loss of two tanks of fuel before Hahndorf could discover the mishap. Worse still, the forward engine, actuated the radio dynamo and this was now useless. The telegraphist had only a small accumulator to work with.

We tried to steer eastwards; but, with two engines and two propellers gone, we began to make worse leeway. We could see the land below and it was becoming clear to me at least that this could not be Germany. The north wind was not abating and the struggle to fly eastwards became desperate. The telegraphist soon reported that his apparatus could no longer transmit. In a last attempt to fly eastward, Kölle determined to come down so as to avoid the tearing wind that was driving us more south than was safe for us. But there was little need to come down very far. In spite of the bombs, ballast and fuel that had gone, it seemed to me that we could scarcely have kept our extreme height, for we had lost much gas.

Shortly afterwards another misfortune overtook us: a third engine failed! This time it was in the after car, where the men had been refilling one of the radiators that had all been steaming heavily owing to the height of our flight. The water-inlet cover had been clumsily replaced, the water had been jolted out or steamed away until the engine grew so hot that the exhaust side was red. In vain they struggled to rectify the damage—it was all to no purpose, and the pistons seized before it could be remedied.

It was, if I rember, at this same time while at a height of some 4,000 metres[1] or rather less than we flew over a large town[2] in the early morning. What it was I do not know. A voice in the car exclaimed "Dijon!" That caused me to think. If that indeed were Dijon then we must fly over Switzerland to reach our own country. We still struggled on, but it was now obvious to me that we should never bring the ship home to our country. Before nine o'clock Hahndorf came to report that the petrol supply was failing and that his men were nearly exhausted.

Kölle turned to his charts once more, but could find none to help him, for they did not extend so far south. So he brought the ship down nearer the ground to look where he might be.

By this time we thought we were over Switzerland and it appeared as if internment in a neutral country would be the only method of putting an end to our sufferings and of avoiding a total wreck of the ship with evil consequences to ourselves. Kölle was doing the right thing, so I felt. Two of the others, as we were coming down, exclaimed "Switzerland! See the snow mountains!" People could now be seen streaming out of their houses to look at the ship, which was now only 1,500 metres up. That fact alone made us feel sure that we had not reached Germany, for at home the population would never be seen rushing out to look at a Zeppelin airship

[1] About 13,000 feet.
[2] This was Lyons.

like this. Before we could land we were to have further unpleasant experiences.

Between 8 a. m. and 9 a. m. we sighted a curious little town in a gorge, such as might be expected in central Switzerland. But the country was growing rocky and Kölle turned north again to look for level ground for a landing. The valley here grew broad and level—a good place for an emergency descent and we might still save the ship—who could tell? But we were to have a rude shock. Suddenly we saw a large tract of ground cultivated with vegetables. On this there were working some gangs of coloured men—so we could see from their heads and bare arms—all dressed in blue.

"Black men! French soldiers!" rang out a cry. Kölle stamped his foot and hurriedly ordered full speed on an eastward course again. But Hahndorf came in and talked rapidly. His men were exhausted; the petrol supply was nearly running out: he could not go on with only two engines out of five and two propellers out of four in action. It was risky and he pointed to the mountains eastwards. A forced landing would be the only means of saving the crew.

Kölle bowed to the inevitable and maneuvered as though descending at Ahlhorn in Germany itself. He calmly ordered the emergency landing flags to be flown and maneuvered the valves for the landing. We could not but admire our commander in this moment for his conduct was well worthy of what a German naval officer's should be. But ill-luck was to pursue him to the bitter end. In this mountainous valley[1] where we now found ourselves, the north wind was no longer blowing as it had done high overhead, but sharp little squalls were felt at times. As we were touching the ground, so one of these eddies came swirling across the water to our ship. She heeled over to port and the wing car was torn off as it scraped the ground. Two men from the car jumped clear to land. Then lightened of this weight the whole ship seemed to pivot on her nose and was again caught by the wind. Swaying and jolting we were tossed across the stream until the whole craft came hard against the eastern side of the valley where she stuck fast entangled in the bushes and wedged among the stones. It was almost with a sense of gratitude that we clamored or jumped out of the cars. The long ordeal was over, but at what a cost! No sooner were we on the ground than Kölle ordered us to fall into line by the ship. All the ship's charts and papers, all our private papers, he and Schütz collected from us. They were stacked into the forward car. The tools were distributed to us and with them we proceeded to break all the instruments and batter the forward car. Hahndorf drew out the emergency pistol, and fired a blazing charge into the central gas-bags, which were still more than partly inflated. With beating hearts we watched the fire take hold of our fine airship. Some of us who were not too exhausted felt as though our last link with the Fatherland was snapped and that the future mattered nothing. We were brought to our senses as the last few tanks of petrol exploded and we had to run from the blazing gas and spirit. Some were almost too exhausted to move and were helped away to safety. Kölle was splendid in this trying moment. We then gave a last salute to the ship and the ensign as it was vanishing in the flames. But with a hoarse shout as though in pain Kölle made us fall in and marched us up a narrow track out of the valley. The sailmaker had to be carried for his feet were frozen stiff, while two others were almost too ill to walk. So our little party of thirteen struggled on to the neighboring farm where we found a German sergeant in charge of a party of prisoners! What a strange meeting in the enemy's country. This man called his party to him and they helped us to the farm where we surrendered, weak, exhausted and dejected, but still proud of our ship, our

[1] This was the valley of the R. Buèche, near Laragne, in the Department of the Hautes Alpes.

commander, and the great flight that we had just completed. Few men could boast as we might do, that they had accomplished such a journey and thrown bombs at the enemy's great capital! But we were too exhausted to do more or go further.

Shouting brought us to our senses. It was a crowd of French peasants that came to look and jeer at their new prisoners. They had already taken our unfortunate comrades who had jumped from the ship when the squall caught her; one of them was dripping wet—it seemed as if he had been thrown into the water by the cowards of the mob.

So in the end, as prisoners of war, we came to Sistern, for this was the little town that but a few hours before, when in the air, we had taken to be a Swiss town. There we were to spend nearly a year and a half. Among those who greeted us there was the crew of the military Zeppelin Airship *LZ-85,* which had been shot down by the English eighteen months before at Salonika. We shortly compared notes with them, but they did not and could not understand what we had achieved. Such were the changes that had come over airship navigation since their day! And then moreover, the military personnel had never had the same training as we. They had never flown for hours across the sea; they had never climbed so high into the air; they had never suffered from the cold; so they could not understand what we had undergone. Quickly we began to recover from our nerve-shattering experience, but although we all, even the sailmaker, finally regained our health and our spirits, I do not believe that any of us would willingly have undertaken another such war flight as that which we had achieved with Kapitän Leutnant Waldemar Kölle, in L-*45* over the city of London. Now I am too old to begin again, but Germany will, I am certain, at some time in the future, yet produce airships and airplanes that may achieve the task which we attempted to complete. We failed on account of the gas and of the weaknesses of our bodies, but German courage and German will to conquer will never be quenched. Deütschland über Alles! is still the call of our race—on land, on the sea, and in the air!"

A Navy of Peace

By Sir Herbert Russell, *The Naval and Military Record,* 17 February, 1926.—It is unquestionably true to say that never in the history of the world has the prospect of a great naval war appeared more remote than it does at the present moment. Talk about disarmament has assumed a very much more definite note since the Locarno Conference, and there seems to be little room for doubt that we are on the eve of a new move in the direction of reducing the fighting forces of the nation. But idealism is always profoundly optimistic. We are apt to shelve, or to minimize, certain considerations which obtrude upon the vision of a world in such perfect accord that any idea of armed conflict appears too preposterous to soberly entertain. Agreed that the general frame of mind of humanity now is that bloodshed and destruction is really a barbaric futility (for we are near enough to the memory of it to realize all that war means), and that, after all, what quarrel can be worth the principle of "smashing" one of the disputants?

Mankind has passed through this phase before, and curiously enough, it has more than once proved the prelude to the decline. Never before has the "will to peace" found such concrete expression as today; never before have the chancelleries of the world leagued together to try and devise a formula which shall effectually supersede the appeal to arms. This is admirable. And yet there are countless perfectly benevolent thinkers who view it with dubiety. For it is all based upon the taking for granted of a stage of perfection in the evolution of human nature which it needs a great faith indeed to accept as otherwise than speculative. Today the nations see nothing to fight about, and they are still war-weary and im-

poverished. Therefore, they are assumed to be ripe for a compact which renounces war.

But will "the will to peace," even with the international machinery for its enforcement, always trimph over the provocation, or the temptation, to strike in support of denied rights or un-redressed grievances? Will the moral element always prove superior to the martial spirit? Arbitration, like an action at law, always leaves one side dissatisfied. The League of Nations will depend primarily on the *force majeur* of morality. It will also possess a very powerful weapon in its ability to influence economic conditions. But will passive force suffice to keep subdued the instinctive violence of an inflamed national passion? If so, then human nature has radically changed—and changed rather suddenly.

The thing will be a tremendous experiment, and, as all right-minded men will concede, an experiment worth trying. But like all great experiments it must be approached cautiously; its success must be hoped for rather than assumed as a foregone conclusion. Which means that there must remain a prudent provision against the possible contingency of failure.

From the opening days of the present century down to 1914 we had been steadily creating a war navy. It was being organized and trained to fight with the fixed idea that sooner or later it was bound to fight. Today we are maintaining a peace navy. Nobody can foresee any reason why it should be called upon to fight. The pacifists argue that its continued existence at all under such conditions is a sheer anomaly. Such sophistry is none the less dangerous for being perfectly sincere. Is it an anomaly to keep constables parading an eminently respectable neighborhood, or is not this eminent respectability chiefly assured by their presence?

It is an ordination of nature that we live upon one another. Animals prey upon animals; men, in various forms, prey upon men. Socialism is a doctrine of pure preying without violence; Communism is preying with violence. War gives a cohesive and organized form to the brute (or natural) instinct in man. But that instinct can find plenty of scope outside of war, given opportunity. Rum Row simply palpitates with it. The sea is always bound to be a greater preying ground than the land. The modern art of piracy, as practiced in Chinese waters, is only kept in check by the British Navy. Comparatively few of the pirates are captured, but the knowledge that warships are always prowling about in quest of them restricts a business which is so attractive and profitable that but for this vigilance it would soon render the China seas more unhealthy than the Antilles in the spacious days of the buccaneers.

I confess that I have never been attracted by the expression "police work" as applied to the Royal Navy. In the first place it lacks dignity, and in the second place it is far too limited to cover the rôle of the sea service in peace time. We did not say that the old frigates and brigs which chased the slavers betwixt the Bight of Benin and the Middle Passage were engaged on police work; why, then, should we apply the term to the men who are ever on the watch for slave dhows in the grilling reaches of the Red Sea or the Persian Gulf? Is it merely for the want of effort to coin a better term?

The League of Nations will, in all probability, succeed in bringing about the abolition of battle fleets, and with their disappearance the end of the grand clash warfare for which they stand. But beyond such a likely result it is very difficult to see clearly. My own belief is that war navies will give place to peace navies. This sounds a mere paradox. Any navy, it may be argued, must always remain a war navy, since it is created and trained to fight. But surely the differentiation is both obvious and legitimate. A fleet which is kept up for the sole purpose of enforcing law and order and peace represents a very different national ideal from that of a fleet which is destined for the fulfillment of great aggressive ambitions.

Without the existence of peace navies the League of Nations must be perpetually confronted by the possibility of impotence. The effectiveness of its "sanctions" will largely depend upon the extent of its ultimate power to enforce them. The verdict of a Law Court always has in the background the machinery or bailiffs, commitment for contempt, and such like to ensure that there shall be no ignoring nor evading of the decision. The League of Nations will have to depend upon a certain measure of military strength to give point to its arbitraments. It is all bosh to talk about moral influence. The only influence which is going to carry acceptance of a distasteful mandate lies in the knowledge that there is no way out.

But we still have some rather big problems to deal with before we can settle down to the contemplation of a limited peace navy, and problems which are going to take a long time to determine. Russia is one of them; China is another. From these major puzzles arise many minor enigmas. We do not know what Russia might do, or attempt to do if the world round her burnt its boats and broke its swords. What we do know is that it would be sheer insanity to give her an opportunity of enlightening us. Domestic strife in China is dangerous on account of the possibilities of external exploitation with which it is pregnant. There is no need to develop this theme; I merely introduce it as a reminder.

The United States has to become very much more definite in her attitude before we can take her participation in the new "golden dream" for granted. There is a good deal of talk about disarmament in America, and nobody doubts the sincerity of her desire for world peace. Even on the most prosaic grounds this sincerity may be associated with the fact that she, of all the great nations, could have nothing to gain from war. But between a large, indefinite, and somewhat patronizing form of sentiment and practical policy there yawns a gap which the rest of the world wants to see bridged in some fashion. What is she going to do about the League of Nations? What is she going to do about the hegemony of the Pacific? A consistent pose of superior aloofness does not go well with benevolent admonitions to the rest of the world. The United States is at perfect liberty to order her affairs as she chooses. But the fact remains that her policy is bound to react upon anything and everything proposed by the League of Nations. The other great powers cannot acquiesce in a posture of privileged exclusiveness, of an exalted detachment accompanied by a great deal of moralising and advice. If the prestige of the United States will not permit her to make common cause with the cosmopolitanism of Geneva, the other great nations are bound to take the line that prestige is not a monopoly. The Monroe Doctrine is not yet "what the United States choses to make it."

These are things which yet have to be disclosed. Disarmament of itself may be nothing more than a deceptive gesture unless it is based upon a genuine reversion of the spirit which creates great aggressive armaments. A Germany disarmed by force remains a sinister menace to future peace; a Germany disarmed by inclusion in the comity of Locarno becomes a guarantor of future peace.

We are entering a great academic field. Practical fulfillment lies on t'other side of the hedge. That hedge is partly made up of goodwill and partly of economic necessity—just in what proportions it is not easy to determine. The peace navy will probably diminish gradually—very gradually, I believe—in tonnage and man-power for some years to come. That is to say, we shall withdraw partly-worn-out ships in a much bigger ratio than we shall build new ones. A new theory of the "uplift" of human nature is to be put to the test. At least it is an interesting experiment in this very imperfect world.

Concerning Sea Warfare

By Sir Herbert Russell.—*The Naval and Military Record*, 10 March, 1926.—I suppose it is only natural that in proportion as we find ourselves in complete agreement with the expressed views of a thinker, so we base our judgment of the ability of that thinker. Particularly is this the case in connection with any subject of many controversial facets. Vice Admiral Herbert W. Richmond, fresh home from the East Indies' Command, has just delivered two lectures (February 18 and March 4) at the London University upon the very comprehensive subject of "Sea Warfare." I confess I came to these lectures with a predisposed consciousness of agreement. Vice Admiral Richmond is one of the leaders of progressive naval thought, a man of wide vision, who looks beyond all the pawns and the players of the game to the great principles of the game itself. What we call the Material School has, quite involuntarily, steered us into haze. They tell us, in effect, that the machine is now master of the man. Such a doctrine represents a confused inversion of method and principle. It has bred intensified specialism, and a concentration upon the means which fails to project itself into the spaciousness of the end.

I am not attempting to deny the essential value of material preponderance as an element of victory. But to focus contemplation entirely upon this element leads us into watertight compartments. To rejoice in the production of a ship which by virtue of superiority in tons and guns can beat any enemy ship is to distort strategical vision, in the perspective of which the man must always remain master of the machine. It seems to me that the tendency has been to forge great weapons without sufficient attempt to realize just how they are going to be used. The "smashing" theory of warfare is very attractive to the popular mind. But is it the theory which is necessarily going to win a war? The Germans gave full fling to their belief in "frightfulness." It is probably true to say that they overawed certain minor powers which might otherwise have risen against their proclaimed purpose of dominance. But they aroused great powers which would otherwise have been quite content to maintain neutrality, and to limit the struggle as far as possible. Did it really pay Germany to overawe Holland, and Denmark, and Norway at the expense of raising against her the British Empire, Italy, and the United States?

War being but a means to an end—peace—it follows that the most effective method of waging war is that which shall make for the best peace. The creed of Prussianism denies this. War, it holds, means the crushing of a foe to such a degree that he must accept any yoke his conquerors may impose. This idea was practicable in the days of Attila and Saladin. In twentieth century civilization it simply doesn't pay. Germany would have got a far more generous peace and a far more quickly settled peace had it not been for the ranking memories of Louvain, of the Lusitania, of poison gas, of baby-killing, and of the countless barbarities which she enacted in the name of that atrocious fallacy of "the good old German god" which her leaders called "military necessity."

This may appear somewhat irrelevant to Vice Admiral Richmond's lectures on "Sea Warfare." As a matter of fact the association of thought is intimate. I observe he dwells much upon the phrase "disabling the enemy." He obviously prefers it to "defeating the enemy," "crushing the enemy," "destroying the enemy," or the other dramatic phraseology of the exponents of war who always seem to be ferocious in the inverse ration to their actual knowledge of war. I confess I like the theory of disabling the enemy as the adequate function of military effort. A disabled enemy cannot go on fighting, and may, therefore, well be prepared to make a good peace. A crushed enemy means a bitter and resentful people imbued with the fixed intent of a war of revenge.

Admiral Sir Reginald Custance has written a very sagacious treatise on "The Study of War." But his premise differs from that of Vice Admiral Richmond. He compares two nations fighting with two men fighting. He says that when the dispute becomes a matter of combat the result of the combat finishes the matter. I do not think the analogy a true one. It postulates that when nations fight the naval battle and the military battle are the final things, and that therefore victory in battle is the only thing to aim at—in fact, the final object.

Vice Admiral Richmond takes another view. When nations quarrel, nations fight. The combat on the part of a very small proportion of the nations is not the end, but the means to the end. This distinction is essential; without it the planning of a war is impossible. The signification of the term "strategy" has now been broadened to embrace political, economic, and social conditions as well as purely military considerations. The basis of every plan of war is to force the enemy to compliance. Old-time methods have become rather dangerous fallacies. The traditional precept that the first business of the British Navy is to seek out the enemy and destroy him still sounds very fine, but followed literally, by the light of the sketchy doctrine misnamed "the Nelson touch," it may easily lead to the destruction being on the wrong side.

Indeed, when one endeavors to clearly realize what really is the end for which war is waged, one gets back to Aristotle, or Turpin de Crissé, who contend that the aim of war is peace. Monteaiculi said that the aim of war was victory. As a means to the end—yes. Vice Admiral Richmond differentiates very subtly between the aim *of* war and the aim *in* war. The purpose in the latter case is to determine the course of action, not the ultimate object. To say that the one is the corollary to the other is to miss the point of the differentiation. Since the aim of war is really peace, the taking of steps in war which may render the making of peace more difficult—as Germany so deliberately did—is really antagonistic to the ultimate object. Peace is not going to lastingly rest upon hatred. Ruthlessness may procure victory, but as a matter of experience it does not pay.

Vice Admiral Richmond's lectures dealt with two phases. The first was devoted to grand strategy; the functions of the fleet ending with a review of the need for bases as a preliminary condition to the planning of operations: the second was devoted to the duties the fleet has to perform in order to fulfill its war functions. Regarding the question of the most suitable types of ships the distinguished officer had little to say, for, as I have indicated, he was dealing with principles rather than with methods. He discusses two broad strategical alternatives: to invest an enemy by dispositions and by blockade which holds him to his ports, and to neutralize an enemy by attaining command of the sea in such zones as he seeks to operate in. He gives us examples from history. During the Spanish war in the reign of Elizabeth we ineffectually tried the principle of investment. During the Dutch wars of the Commonwealth period we very effectively established investment.

I only wish I had the space in which to do justice to this brief but absorbing study of sea warfare by one of the most profound students of it of our day. On the eve, as we are, of further international discussion upon the limitation of armaments the need of a clear appreciation of the principles which Vice Admiral Richmond expounds is self-evident. It seems to me that what we should seek to visualize is just *what* we have to fight at sea? The great maritime power than can successfully wage war against the commerce of another great maritime power is the nation on whose side victory should die. Therefore the primary business of the fleet is to protect commerce; in other words, to keep the trade routes as clear as possible of enemy warships. Control cruisers can only fulfill their rôle by consent of battleships, so long as the battleship continues to exist. Presuming

the capital ship to vanish, the cruiser will take her place, and the whole conception of sea battle will be altered. Instead of seeking decision by a great fleet action—and I doubt if it can be really claimed that there have been a half-a-dozen decisive fleet actions in history—it will be sought in the destruction of convoys, and the warships guarding convoys. We shall come to smaller types and larger numbers. Silent pressure and passive resistance will tend to disappear before more intensive activity and naval tactics will become more desultory. But whatever changes may happen in this way, they will be but changes in the means. The end, as Vice Admiral Richmond maintains, remains as fixed and unalterable as all other great first principles. And yet there are those who give to it varying definitions.

Progress in the Study of Engineering

By W. E. WICKENDEN, *Director of Investigation of Engineering Education, Society for the Promotion of Engineering Education, New York City.—(Digested from "Engineering News-Record.") The Radian,* April, 1926.—It will surprise many to learn that there are 166 degree-granting colleges offering complete engineering courses in the United States and Canada. Of this group fifteen are independent polytechnic institutes, fifty-three are associated with independent or sectarian colleges or universities, while ninety-eight are under public control. Judged by the composite standard of number of colleges, students enrolled, teachers employed and financial outlay, this is easily the largest division of professional or vocational higher education in America.

The average annual cost per student, exclusive of interest and depreciation on plant, has been found to be as follows in four groups of these colleges; endowed universities $582; endowed polytechnic institutes, $551; state universities $358; and state land-grant colleges, $298. The average investment per engineering student was found to be difficult to segregate in the mixed institutions, but the figure for the polytechnic institutes is $7,854.

These items of cost and investment indicate that the annual direct outlay by the colleges of engineering of the United States is approximately $30,000,000 and that the total investment in the special facilities of engineering education approaches $300,000,000. When considered alone the total expenditure on this entire group of education studies seems large, but when compared with the operating budgets of the colleges directly concerned it is actually quite small, perhaps one-third of one per cent for the entire three-year period. A very moderate increase in education efficiency would pay handsome dividends on the investment.

WHAT KIND OF STUDENTS ARE WE GETTING?

Comparatively few engineering colleges draw students from a wide area. On the average a fourth come from the immediate vicinity of the college and can live at home. Half come from within a radius of one hundred miles and 80 per cent attend college within their own state.

Four out of five engineering students come from public schools, while one in eight comes by transfer from some other college and one in sixteen comes from a private school.

As the product of the secondary school runs, the engineering colleges are getting a goodly share of the best students. Sixty per cent come from the upper third of their class, 37 per cent from the middle third and only 3 per cent from the lowest third. All but 6 per cent of the engineering colleges admit their students without examination on the credentials of the high schools. One-fifth of the students admitted in the fall of 1924 were "conditioned." Many cases thus classified represented deficiencies to be made up rather than inferior records. However, the mortality of conditioned

students is appreciably higher than among those with clear entrance records. Some tightening of requirements at this point, especially with regard to mathematics, appears to be in order.

Table I—Showing How Many Engineering Graduates Remain in Engineering:

Engineering Course in College	Per Cent in Same Field	Per Cent in Allied Field	Per Cent in Non-Allied Engineering	Per Cent in Non-Engineering Field
Civil	73.6	2.5	10.1	13.8
Mechanical	58.0	10.5	15.1	16.4
Electrical	56.7	7.3	17.1	18.9
Chemical	47.2	13.9	24.1	14.8
Mining	35.5	15.8	25.0	23.7
Composite of all groups	60.0	7.5	15.4	16.6

The social, economic and cultural backgrounds of engineering students may be judged from the following records regarding their fathers. The positions of the fathers are, in percentages: owner or proprietor, 42 (including farmers 17); executive or supervisory, 28; workmen and clerks, 13; engineers of various kinds, 4 per cent. Fathers in industrial pursuits include 29 per cent; professional, 16; financial or mercantile, 22. Holders of college or professional degrees among the fathers were 13 per cent; attended college without graduating, 11; high school courses only, graduates 16, less than graduation 62 per cent.

In general engineering students are of substantial origins and backgrounds, better than average scholastic ability and preparation, and of a high degree of social and economic assimilability.

Choice of Career and Educational Program

Students choose to enter engineering college at a relatively early age, 50 per cent forming this decision before the last year of high school, 27 per cent during the senior year and 23 after graduation The basis of this decision as reported by the students entering college in the fall of 1924 was, in percentages: advice of parents, 14; of teachers, 5; and of others, 6; work done or associations formed, 19; supposed appeal of engineering work, 51; supposed aptitude for engineering, 31; to be able to earn a good living, 27; belief that an engineering course is good preparation for many kinds of work, 24.

Check-ups of the understanding of the scope, content and function of the particular engineering field each student was proposing to enter were made with many freshman groups. The results revealed a surprising lack of acquaintance with the subject and have reinforced the impression that the majority of engineering students choose their program without competent advice or authoritative information. Evidently the engineering profession and the colleges have no small task to perform in the field of vocational information and educational counsel.

Student Mortality and Survival

One advisor of freshmen in the Middle West sums up the general situation most graphically in his annual address to the entering class. "Look at the man on your right," he says. "When you come back next year he'll not be here. Now, turn the other way and look at the man on your left. When your commencement day comes he'll not graduate." Taking a broad average of the engineering colleges, of every 100 who enter as freshmen sixty-one enter the sophomore class after one year, forty-two enter the junior class after two years, thirty-four enter the senior class after three years and

twenty-nine graduate in the normal period. Students dropping back one or more years and others entering on advance standing bring up the ratio of graduates to those who enter at all stages to 38 per cent.

It is a striking fact that nearly 60 per cent drop out before they reach the major engineering subjects of the curriculum and may be said never to have had an engineering try-out. During the past fifteen years, coincident with the vast expansion of secondary education, this situation has become worse, lack of ability, preparation, and interest is the chief cause.

Considering the facts set forth to show that the human material being dealt with is decidedly above the average, this record of mortality raises a whole series of doubts. Is secondary education an effective preparation? Is the basis of admission sufficiently selective? Is the basis of choice of an educational program by the student intelligent? Are students scholastically capable but deficient in aptitude or interest? Are the underclass students properly handled and taught? Is the four-year goal of a college course too remote for the majority? Should there be a serious engineering tryout in practice, either before admission or at some midpoint in the course? Should there be a curriculum in two stages, each valuable in itself, with a natural stopping point for many in between and the basis of admission to the upper stage much more restricted?

Regarding Graduates

The first concern of the graduate is to find employment. One-quarter of the number obtain their first position through a teacher or other college officer; about one-fifth through the solicitation of employers; one-sixth through work done prior to graduation; one-tenth through family connections; and one-fourteenth through the aid of alumni. Apparently only one-fifth find positions through their own efforts, or through advertisements or agencies. There is no indication of an over-supply of graduates. The industrial surveys indicate that large parts of industry are definitely under-recruited. The startling salaries of today are on a par with those of fifteen years ago, making allowance for differences in the purchasing power of the dollar.

In choosing their first positions graduates are strongly influenced by the line of study pursued in college. Only one in ten takes the only job available and only one in twenty-five is swayed by the lure of the immediate salary as a primary consideration. Young graduates shift positions quite actively in the first three years. For example, the returns from the class of 1922 indicated that 25 per cent had had three employers, 32 per cent, two, and 43 per cent one in the first two and a half years after graduation.

Merits and Defects

The large groups of graduates who have been canvassed, together with large bodies of active engineers and industrialists, have given a significant appraisal of the merits and defects of engineering education. As a means of developing accuracy and thoroughness the rating given is very high; as to diligence, integrity, reliability, initiative and originality it is uniformly moderately high; while as to the qualities of leadership it is moderately low. The technical and scientific preparation is rated as good in relation to the requirements of practice. The cultural content is rated in the range from justified to indispensable by all but one-seventh of the graduates. More than half identify economic and business subjects as the most important omission, one-fourth designate English under this head.

In their recommendations for improvement, one-sixth of the graduates put more business training first, another sixth more practical training, another sixth suggest the lengthening of all courses, and another sixth ask for more or better cultural work. One-eighth suggest less specialization

and one-sixteenth more or better teaching of the sciences. Less than 2 per cent suggest more or better teachers as the improvement most needed.

Table II—Activities of Recent and of Older Graduates

Type of Activity	CLASSES OF 1922, 1923 and 1924	CLASSES OF 1909 and Before
Consulting engineering	2.1	8.0
Drafting, estimating and design	28.4	7.9
Construction, operation, testing, etc.	29.3	4.7
Teaching and research	11.4	9.6
Administration and management	8.8	45.8
Sales	6.4	4.7
Clerical, manual and miscellaneous	13.6	3.0
Primarily technical	71.2	30.2
Primarily administrative	28.8	69.8

If the engineering colleges are content to share the widely prevailing level of collegiate education in general, only incidental improvements may be expected or are needed to maintain their favorable position. Notable advancement will be possible only by lifting engineering education to a plane of effectiveness distinctly above other undergraduate colleges. Such an ambition is both worth while and attainable.

What Is Disarmament?

New York Times, 14 March, 1926.—The recent halt in preparations for an armament conference in the face of an obviously growing desire for disarmament among the peoples of the world is occasioning comment both widespread and varied. In the latest issue of *Foreign Affairs* General Tasker H. Bliss subjects the situation to an analysis as keen as it is commonsensible. Armaments, he says, may be defined as agencies "solely for the purpose of international war." Even with the best will to reduce these the practical difficulties are great. One nation places reliance an airplanes, another on submarines, a third on land forces. Any proportional reduction involves a weighing of one agency against another; but what is the common denominator? Even in the matter of naval retrenchment, so ably handled at Washington, certain questions of this kind proved unanswerable. In the current *New Republic*, Mr. Sisley Huddleston quotes a European statesman about to enter an armament conference who had a formula. "I have set down proposed coefficients of national armies—say five for France, four for England, three for Italy, two for Czechoslovakia, and so forth. I do not in the least mind how much the coefficients are twisted and turned. My purpose is to force some kind of decision." Nothing happened and Mr. Huddleston is scandalized. He will do well to read General Bliss.

Something even more incalculable than armaments is involved. Modern war is basically industrial. "The nation which is best organized for peace," says General Bliss, "which is the most abundantly supplied with the agencies which have come with civilization and upon which that civilization largely depends, and with the facilities for the production of them and with men skilled in their use, is the one best organized for war." Behind even this lie questions of resources in food and raw materials, without which the best of armaments and the most perfect industrial development are futile; "of geographic situation, vulnerability of frontiers, etc.," and, finally, of man power. If the citizens of a given country make better soldiers, are they to be proportionately deprived of arms? At a conference each nation will have to be satisfied that all of these variable factors be set off against one another with evident justice and precision. "No progressive nation will allow it-

self to be penalized because of its progress in peaceful pursuits." Yet quite as forcibly as Mr. Huddleston, General Bliss urges the need of a conference. It will mean much if the terms of the problem are clearly fixed in the public mind—much even if the result is no more than an earnest gesture. The danger of another war is so great that every resource against it must be tried, every failure encountered with resolution and an ever vigilant hope.

As an incentive to such patience and such hope, General Bliss points to the story of the League. The "sanctions" provided by the Covenant failed to operate. The Draft Treaty of 1923, designed to validate them, was generally repudiated. The protocol of 1924 marked a great advance toward the guarantee of security, but itself raised problems for the time insoluble, and so was abandoned. Meantime the World Court had arrived, and the idea of designating as aggressor a nation refusing to submit its cause to the processes of justice. The Dawes plan had brought an inspiring example of the beneficence of expert investigation and decision. The result of all this was the Treatise of Locarno—a merely local application of the basic plea of the Covenant, yet marking an epoch of progress. General Bliss looks to the time when the danger spots of the world will be overspun with such understandings, embodied in the written word.

The motive for armaments today, he points out, is not so much national aggressions as national fears. These can best be allayed by building up international understanding and an international trust in established justice. "Disarmament will proceed only as peaceful methods for settling disputes are substituted for war." Yet as the Covenant led to Locarno, so each successive armament conference should help toward the time when the nations have courage and faith to lay aside their weapons.

Is the Immigration Act Defeating Its Purpose?

Magazine of Wall Street, 27 March, 1926.—When the legislators framed the National Immigration Act they did not foresee that it might bring about the very opposite situation from that planned. The principal economic reason for restricted immigration is to keep our workers from competing with an influx of cheap foreign labor in this country. But, as shown by the steadily increasing competition with American industries, the effect actually is to place American labor at a disadvantage since foreign workers, who are prohibited from the coming to this country in large numbers, are compelled to increase their production at home or starve. This article casts a totally unexpected light on a situation which may exert a pronounced effect on American business and is to be welcomed as a startling contribution to knowledge of what the future may bring forth.

Is immigration restriction an unmixed success?

Like prohibition, a scoffer might say, "Let's wait till we try it before we answer."

Officially the net immigration of aliens to the United States during the first fiscal year of the new quota law, ending June 30, 1925, was only 202,000.

Nobody knows what the bootleg immigration was; perhaps it was another 200,000. If so, our net immigration is not so much smaller than it used to be when there was no numerical restriction by law.

But for the purposes of this discussion we shall assume that alien immigration is legal immigration. Then, against the million of some pre-war years and the annual 400,000, net, of the four immediately preceding years we are now receiving only 200,000 immigrants a year, after deducting emigrants. Of these 200,000 a little over 100,000 enter gainful occupations.

Is that enough for a growing and expanding country which before the war absorbed 627,000 immigrants a year of whom more than 300,000 were economic workers? If our national economy has not yet arrived at the "diminishing returns" stage, the obvivous economic answer is that we who

are here will suffer because we deny access to our industrial circle to hundreds of thousands who would come.

So long as we could provide work for the foreigners we were all better off in a business sense because they came. They earned more than their keep, else they would not have found jobs, and the surplus was a net addition to national wealth.

But the real situation is worse than the stark figures make it. Of the 200,000 net immigrants we are now getting, Canada—not affected by the quota law so far as Canadian citizens are concerned—is giving us 100,000. Except for the French Canadians, of whom we are receiving about 20,000 a year, the Canadians are pre-eminently white-collar immigrants. They contribute but a small quota to the manual workers and scarcely any to the rolls of common labor. "We are maintaining the best public school system in the world," a Canadian educator recently remarked to the writer, "for the education of future Americans." The "new immigration" from Europe is only 20 per cent laborers—and one-third of them are agricultural.

It is doubtful if the immigration act is giving us a gain of much more than 50,000 alien industrial laborers a year; one-sixth of what we have been absorbing with ease.

Including the natives, it is estimated that our present rate of industrial growth requires 750,000 new workers a year—or fifteen times our present worker immigration and 300,000 more than natural and immigration population growth now yield. Such figures as these seem to explain why a nation that is about half immigrant and the children of immigrants voted—as reflected by Congress—overwhelmingly for keeping the foreigners out—mostly—hereafter. It would appear that immigration restriction would be the greatest boon American labor ever had. Almost two eagerly beckoning jobs for each new laborer. Opinion, even among those who would abolish the numerical restriction law, is practically unanimous that from the point of view of labor there is only one view of restriction. Organized labor, at least 50 per cent of recent foreign origin, is unanimously and fiercely in favor of the law.

But is the question so simple, even from labor's viewpoint?

After all, the laborer is a social unit. He cannot escape general social ills. For example, the high cost of labor that seems indubitably to be resulting from immigration restriction may result in an even higher cost of living and a decline in actual wages. Housing has already reached unbearable costs, chiefly because of costly labor. The cost of living is again ascending.

The lack of common labor is likely to result in great and widely ramifying industrial disruptions. So far, the flow of labor from the country to the industries and the movement of negroes from the south to the north has made the labor scarcity endurable. But these are only temporary adjustments. A revival of agricultural prosperity—by no means impossible—will send vast numbers of laborers back to the country. It is conceivable that the industrial expansion of the country may be so checked for lack of common labor that there presently will be a surfeit of skilled labor.

Likewise with the white-collar workers. An abundance of common labor is apt to be the only insurance of employment for the skilled workers and the clerical people. One reason why people have got on and upward so well in America is that they have had the willing manual laborer from Europe to climb over. With fresh millions of humble workers pouring in to do the hard and dirty work, Americans have found room at the top. If there is no bottom there can be no top—for those between. That means a rigid society, and a job something to be inherited and tenaciously clung to. America Europeanized because we reject Europeans!

Again, is it not possible that, while immigration restriction does protest the American labor in the sense that it momentarily vastly reduces the personal competition of laborer against laborer for a job, it eventually increases

the competition of labor products? *What will it profit the American laborer if he keeps the foreigner out but thereby increases the flow of foreign goods into this country and the competitive markets of the world?* Despite the highest tariffs we have ever had our imports are attaining unheard of dimensions. Our textile industries are already staggering under the pressure of foreign competition in the home market, to say nothing of the world market.

Europe congested with labor, largely because the American outlet is closed (and whipped on by its colossal debts to America), must find work at any cost. The would-be immigrant who would like to be a high-wage producer and high-standard consumer in this country, unconsciously revenges himself for his lost oppportunity by producing more abroad and consuming less in the struggle to exist.

He forces his cheap products into the United States and restricts his consumption of American goods. He congests our domestic and foreign markets with his goods and takes none or less of ours. And he is learning machined industrialism and mass production. Not only is the continental European a cheaper worker but his work—his actual labor cost—is becoming cheaper than ours.

Secretary of Labor Davis says that the main cause of cyclical unemployment in the United States is the over-capacity of our industrial equipment. What will the next phase of depression bring to American labor if that over-capacity is in effect increased by a foreign competition that nothing short of an embargo can stop? We desperately need wider foreign markets. How can we get them when every man in Europe who can get a job is working harder than ever because the millions who formerly came to the United States to make new markets, as well as products for those markets, must work—or starve—at home?

The writer is not unaware that there are answers to these questions, whether sufficient or not. His purpose is to interrogate rather than to affirm. It is not his intention to denounce the immigration law. Man does not live by meat alone, and there may be—probably are—other and controlling reasons for the restriction of immigration. But if we must pay the price in economic pinch, we should face the facts and chart our course accordingly; not wait until we are mystified by an industrial slump without reason according to all the rules—and then explore for what we should know now.

Cruiser Strength of Five Dominant Nations Analyzed

By Hector C. Bywater.—*Baltimore Sun*, 14 March, 1926.—The launch of the British cruiser built to treaty stipulations affords an opportunity for reviewing the relative position, present and future, of the leading navies in regard to a very important type of fighting ship.

Taking the British Empire first, we find it to have seven treaty cruisers actually building and four ordered for immediate construction. These eleven ships are named: *Suffolk, Berwick, Cornwall, Cumberland, Kent, Canberra, Australia, London, Devonshire, Shropshire, Sussex.* They are understood to be of uniform design, with a displacement of 10,000 tons at light draft, a battery of 8-inch guns, and a speed equal to that of any coeval foreign cruiser. The first seven ships are to be ready for sea next year, the remaining four by 1928. Humanly speaking, the completion of these eleven vessels is assured.

Twelve further cruisers are contemplated, but the fulfillment of this project is conditional on the Conservative government remaining at the helm till 1930, in which year the last three ships are due to be laid down.

But a great deal may happen in the political world during the next five years, and there is little doubt that a change of government woud involve a

drastic reduction in the shipbuilding program. It will be recalled that the first Baldwin Cabinet adopted late in 1923 a plan for building fifty-two cruisers at the rate of five a year. The short-lived Labor administration of 1924 scrapped this plan and authorized a single group of five cruisers. When the Conservatives returned to power they brought forward a modified version of the old program, covering a period of five years and providing for a total of sixteen new cruisers—additional to the five ordered by the Labor Cabinet and two by the Australian Government.

Assuming for the sake of clarity that this program is carried out in full, the British Empire seven years hence will have twenty-three cruisers of post-treaty design. Sixteen of these will be 10,000-tonners, armed with 8-inch guns, and seven will be 8,000-tonners, probably of lighter armament.

Of the cruisers already completed the following will remain effective for oceanic service: *Hawkins, Vindictive, Effingham* and *Frobisher,* of 9,750 tons, 30 knots, armed with seven 7½-inch guns; *Emerald* and *Enterprise,* 7,600 tons, mounting seven 6-inch guns, and the *Adventure,* 7,260 tons, a cruiser-mine layer, whose speed and battery have yet to be disclosed.

When these seven ships are added to the post-treaty units building and projected, a grand total of thirty fast cruisers of ocean-going tonnage results.

Japan comes next in cruiser strength, with twenty-five modern ships built or on order, the last of which will be completed in 1929. Of these, however, only four—*Nachi, Myoko, Ashigara* and *Haguro*—are 10,000-tonners, of 33½ knots, mounting nine 8-inch guns. Four more are ships of 7,100 tons and 33 knots, armed with six 8-inch guns.

It may be pointed out that Japanese ships of every type that operate in the Western Pacific possess a freedom of action far beyond that indicated by their fuel capacity, thanks to the series of insular bases under Japanese control, extending from the Bonins—500 miles southeast of Tokio Bay—to the Marshall Islands, distant nearly 3,000 miles from the coast of Japan. It is exceedingly probable that this factor has influenced the design of recent Japanese ships, notably the four 7,100-ton *Kako* cruisers, which although of moderate tonnage, have a high speed and very heavy battery.

Their fuel supply must be comparatively small, but with numerous friendly bases scattered about the ocean they could always count on replenishing bunkers, so that their limited fuel endurance does not detract from their military value.

The United States Navy has ten modern cruisers of homogenous type—7,500 tons, 33¾ knots, twelve 6-inch guns. While they appear to be excellent ships of their class, they are, of course, eclipsed in fighting power by the 8-inch gunned treaty cruisers, which they could not face without running the risk of destruction. Two 10,000-ton ships have just been laid down, and six more are authorized, but no funds have, so far, been voted for their construction.

France is building three 10,000-ton cruisers—*Duquesne, Tourville, Suffren*—and projects three more for completion by 1932. Italy has two ships of corresponding tonnage on the stocks and has legislated for two more. On the basis of these figures the following approximate tabulation of cruiser strength in 1932 has been compiled:

	9,000-10,000 1st Class Tons	6,000-8,000 2nd Class Tons	Below 6,000 3rd Class Tons
British Empire	20	10	20
Japan	4 to 8	4	17
United States	2 to 8	10	..
France	6	3	..
Italy	4	..	..

Whether these totals will actually be reached by the year in question depends on so many unforeseeable contingencies that the list can only be regarded as provisional.

The above table shows, roughly, that if all current programs mature without revision, the British Empire in 1932 will have gained a long lead in cruiser strength. In the oceanic class the United States Navy will be equal to Japan, though having regard to Japan's unique advantage in Pacific base facilities the equality will be less real than apparent. If the United States desires to maintain its relative position in the Pacific it will have to build all the eight authorized treaty cruisers without delay, and, in addition, provide funds for the early construction of at least ten further ships of this class.

It looks however, as if economic stress will eventually compel all governments to devise some less expensive form of cruiser than the 10,000-ton standard type which the professional experts at the Washington Conference gratuitously foisted on the naval world.

CURRENT PROFESSIONAL NOTES AND PAPERS

"Boiler-Water Conditioning for High Operating Pressure and Corrosion. Flue for Computations." *Mechanical Engineering*, April 1926.

"Modern American Aircraft Engine Development." *Aviation*, March 15, 1926.

"Effect of Use Upon the Steam Rate of Turbines." *Power*, March 23, 1926.

"Die Casting of Aluminum Alloys."

"Trans-Atlantic Wireless Telephony." *Engineering*, March 12, 1926.

"A New Type of Refrigerator." (Thermo-Syphon, no reciprocating or rotating parts). *The Engineer*, February 19, 1926.

"On Divorcing the Air Service." *U. S. Infantry Journal*, March, 1926.

"Anti-aircraft Defense." *Army Ordnance*, March-April, 1926.

"Naval Guns vs. Shore Defenses." *Th Coast Artillery Journal*, March, 1926.

"Shooting Up the Carribbean." (Commander E. E. Wilson on small bore rifle work). *The American Rifleman* or *The Coast Artillery Journal*, March, 1926.

Statement of the First Lord of the Admiralty, Explanatory of the Navy Estimate, 1926.

Arrangements have been made for all Executive Officers to undergo a short course in elementary Naval Aeronautics in an Aircraft Carrier, either during the last year of their service as midshipmen or at the first opportunity subsequently as junior commissioned officers. Such arrangements will, it is hoped, increase the interest taken by junior officers in the work of the Fleet Air Arm, and will be of considerable value to them later, even should they not decide to specialize in Air duties.

NOTES ON INTERNATIONAL AFFAIRS

FROM 3 MARCH TO 3 APRIL

PREPARED BY PROFESSOR ALLAN WESTCOTT
U. S. NAVAL ACADEMY

GERMANY AND THE LEAGUE OF NATIONS

STRIFE FOR COUNCIL SEATS DELAYS GERMAN ENTRY.—The special session of the League of Nations Assembly met at Geneva on March 8 and ended on March 17, without having accomplished the purpose for which it was convened, that of admitting Germany to the League. With the consent of Germany it was decided that the question of Germany's admission should be postponed until the regular session of the assembly in September.

Germany was supported by Sweden and other northern nations, as well as by public and parliamentary opinion in England, in her stand that she should be given a permanent seat on the League Council, upon her admission to the League, without at the same time increasing the council by the addition of other members. France and other nations, however, favored a permanent seat for Poland, who advanced her claims at this time. Spain also presented her claims, and Brazil, the only American power represented by a temporary seat in the Council, declared that she would oppose the admission of Germany unless a permanent seat were given to her also.

Various compromise proposals were made, as that Poland should be given a temporary seat on the Council, and that the claims of Spain and Brazil should be postponed until September. Brazil's position, however, was made stiffer by political conditions at home, and in spite of the fact that other American nations objected to her attitude, she remained obdurate.

It was believed that if England had from the beginning taken a clear stand against the admission of Poland as a counterweight to Germany, no difficulties would have arisen; and Sir Austen Chamberlain was even accused of secret promises to Poland and France at the time of the Locarno agreements. Later, however, Sir Austen declared in Parliament that his instructions from London were: (1) to oppose the increase of the council by other powers than Germany, (2) to favor only a temporary seat for Poland.

After the Assembly had adjourned a special committee was appointed to consider changing some of the present rules of the Council, and this committee may recommend increasing the seats in the Council and abolishing the rules requiring a unanimous vote.

From a dispatch by EDWIN L. JAMES in *The New York Times*, March 17:

Without close knowledge of the intertwining interests which got involved at Geneva it is rather difficult to understand exactly what happened. Busi-

ness was conducted in great secret and mostly in hotel rooms. It should be recalled that the Locarno compacts establishing the Rhineland treaty between France and Germany and arbitration compacts between Germany and Poland and Germany and Czecho-slovakia were framed on the basis that they came into existence when Germany entered the League of Nations. This provision was inserted on the initiative of the Allies.

At Locarno M. Briand and Sir Austen Chamberlain, it seems now established, promised Poland, in order to put her in a good position vis-a-vis Germany, to obtain for her a permanent seat on the League Council. However, this promise was not made public at the time. The Germans say they were never told of it and no proof has been produced that they had been.

The Locarno treaties were signed in London and in due time Germany made her application to the League for membership in the Assembly and for the place on the Council which had been promised her. Then, slowly, the Polish demand was brought to the front. Paris espoused it and Sir Austen Chamberlain showed himself favorable. Seeing reorganization of the Council in sight, Spain revived her demand of three years ago for a permanent place on the Council instead of a non-permanent place, thereby seeking to be classed as a great power. Brazil came forward with her plan for a permanent seat as the representative of South America. Sweden took the stand that there should be no other entries to the Council except Germany.

That was the situation when the meeting here started on March 7. Immediately the Germans took the stand that they had agreed to enter the Council as it stood at the time they consented to enter the League, that to admit another nation for the purpose of balancing their vote was an exhibition of bad faith and that if it was done Germany would withdraw her application.

The French, backed by the English, took the position that Germany had asked to enter the League without conditions and that up to the moment Germany was seated on the Council that body was free to do as it saw fit, including providing a new permanent seat.

Germany retorted that the Council could go ahead and Germany would go home.

Long days of weary wrangling brought the result that Dr. Luther and Dr. Stresemann agreed to a compromise by which Poland would replace Czechoslovakia and thus enter the League when Germany did. This would have given the French the diplomatic victory of getting Poland on the Council and the Germans the diplomatic victory of having prevented the enlargement of the Council in order to balance her vote, since the vote of Warsaw would have given France no more strength in the Council than the vote of Prague.

This arrangement, as I have explained, fell through because of the sudden change of attitude of Brazil and Spain, who four days ago had agreed to postpone their demands until September.

While there is no proof, there is a consensus of opinion at Geneva that the Italians took a hand in the affair. Certainly the delegates of Rome have encouraged Spain in her demand for a place, and it is entirely likely that they egged on Brazil. While it seems exaggerated to speak about Mussolini's revenge for Corfu, there seems little doubt that he has had a hand in making this mess. It would not be difficult for him, for he loves neither the League of Nations nor Germany.

GOVERNMENT LEADERS UPHELD.—Following the failure at Geneva, the conduct of the German representatives was upheld in the Reichstag by a vote of 249 to 141. In the English House of Commons a motion made by Mr. Lloyd George to reduce the pay of Sir Austen Chamberlain as Foreign Secretary

(an indirect vote of censure) was defeated by 325 to 136. The Briand Ministry also continued its precarious tenure in France.

ARMS CONFERENCE ON MAY 18.—Before adjournment at Geneva the League Council decided that there should be no postponement of session of the preliminary commission of the Disarmament Conference, but that it should be held, as previously determined, on May 18. It was stated by the government representative in the House of Commons that Viscount Cecil, the English delegate, would go to the Conference with definite disarmament proposals. It was pointed out, however, that proposals for reduction of land forces would come more properly from a power strong on land.

CONFERENCE ON U. S. WORLD COURT RESERVATIONS.—The League Council on March 18 sent the United States an invitation to appoint delegates to a conference at Geneva on Sept. 1, at which all nations members of the Court would be represented, to consider the reservations attached to the application of the United States for membership in the Court of International Justice. Upon receipt of the invitation the United States Department of State indicated that this country would not send representatives to the conference, since the reservations spoke for themselves, and it was for the other member states to decide whether the United States should enter on this basis.

FRANCE

BRIAND CABINET REORGANIZED.—On March 6, on the very eve of Premier Briand's departure for Geneva to attend the sessions of the League Council and Assembly, the Briand Cabinet was forced to resign as a result of a vote in the Chamber rejecting one of the clauses of the government's tax bill. After a hurried visit to Geneva, Briand returned to Paris, and on March 9, succeeded in reorganizing his cabinet with Raoul Peret as new Finance Minister.

The failure of the French Parliament to enact a finance law brings us to this question: Has parliamentary government (government of the people through parliaments or congresses) broken down in France as it has in Italy, Spain, and Greece? Dictators now rule in the last three countries—Mussolini in Italy, General Primo de Rivera in Spain, and General Pangalos in Greece. Must France resort to a dictator to solve her financial troubles?

Premier Briand made the threat to the French Parliament not long ago that France would be placed under a dictator unless that body passed the finance bill. After Briand resigned it was rumored that France might be placed under a military dictatorship with Marshal Foch as Dictator. However, it is more likely that the French Parliament will be given at least one more chance to enact an adequate finance law.—*Current Events, March 21-26.*

ITALY AND THE BALKANS

ITALIAN NAVAL EXPANSION.—The *Literary Digest* of March 6 quotes the *Westminster Gazette* as follows regarding Mussolini's naval policy and ambitions for territorial expansion:

The Westminster Gazette reminds us that Mussolini finds himself, unlike any of his predecessors, with a balanced budget. He has embarked on a bold

naval policy, we are told, to which no legitimate criticism can be offered in view of the vulnerability of Italy from the sea, and we read further: "In the last year there has been much talk of establishing a naval base in Sicily, and a thorough investigation has been held in search of a suitable base. Now we hear that an establishment is contemplated at the Island of Rhodes, in the Ægean.

"The Italian never disguises the fact that he considers himself entitled to Malta, and for years has carried on an infiltrative policy in that island, despite his realization that nothing would ever allow us to relinquish our key position in the Mediterranean. He looks with envious eyes on Tunisia. It is French in government but largely Italian in enterprise. The greater part of the agriculture is performed by Sicilians, its most flourishing syndicates employ Italian labor.

"Again, Italy regards the Adriatic as her sea, and the Adriatic coast as her territory if she had her rights. Did not Venice once hold it in fee? When Mussolini made his melodramatic seizure of Corfu, the old dream of the Doges came to life again. In talking of an empire, therefore, Mussolini knows he has material with which to fire the Italian mind. The danger is that no fire spreads so rapidly as that started to satisfy national ambition."

A special correspondent of this London daily declares that from the strategic point of view the Island of Rhodes is "an ideal jumping-off place for any Italian adventure in Asia Minor." Italy is the strongest naval power in the eastern Mediterranean, he remarks, adding that the Turkish Navy is practically non-existent, the Greek Navy is not yet in a condition of rivalry, while the Jugo-Slav Navy is in its infancy. Transports from Brindisi or from the Italian colonies in North Africa could be easily brought to Rhodes, according to this writer, who calls attention to the fact that it would be "an advance base at the very gates of Anatolia," and he goes on to say: "Italy feels the urge of three forces; her political ambitions, her need for economic expansion, and the pressure of her excess population. The door is closed to the first and third on the eastern shores of the Adriatic; the practical closure of the doors of the United States to Italian immigrants has made the problem still more acute. The second is the failure to make the headway which it was hoped would result from the cession of the greater part of the Port of Fiume.

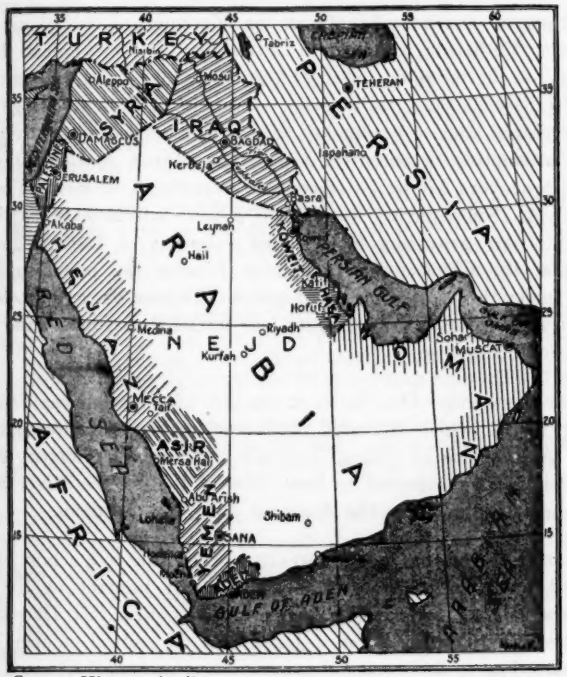
"Italy desires to play the rôle in the Balkans and the Near East once played by Austria-Hungary. But there is her powerful Jugo-Slav neighbor to consider. The Pact of Rome gave the port of Fiume to Italy, and the surrounding parts of Jugo-Slavia, and thus implied a policy of cooperation in the Balkan sphere with Jugo-Slavia. It was tacitly understood that in return for the Adriatic settlement Italy would not interfere with Jugo-Slav policy in the neighborhood of the Ægean. The Pact of Rome is often hailed as a triumph for Signor Mussolini. It was also a triumph for the pacific but realistic policy of Dr. Nintchitch, the present Jugo-Slav Foreign Minister.

The Pact of Rome inaugurated the era of Italo-Jugo-Slav friendship, but it also closed the Adriatic door to Italian expansionist aims in a north-easterly direction. There remains Africa; but the Jarabub agreement with Egypt marks the limits of Italy's possibilities in that direction. Only Asia Minor is left.

"It is true that Italian policy has of recent years been openly friendly to Turkey. Italian money and ammunition helped Mustafa Kemal to turn the Greeks out of Anatolia. But the Greek complication now no longer exists. Likewise Britain and France are no longer at loggerheads over the Turkish question. The diplomatic field would seem to be clear for a change in the Turkish policy hitherto pursued by the Palazzo Chigi."

TURKEY AND NEAR EAST

FRANCO-TURKISH ACCORD.—(From *April Current History.*)—An interesting diplomatic maneuver was disclosed on February 21 when it became known that Senator Henri de Jouvenal, French High Commissioner for Syria, had concluded an accord with Turkey, whereby each country bound itself to a benevolent neutrality in the event of either being at war, and also settled various controversies relating to the frontier between Turkey and Syria and to the use of the Bagdad railway. It had been asserted that such an accord would be a negation of the obligations of



Current History, April

MAP OF ARABIA

France to enforce the sanctions of Article 16 of the Covenant of the League of Nations against any nation incurring such penalties. It was likewise asserted that this accord was not to be considered as an agreement between France and Turkey, but rather as an adjustment between Turkey and Syria which, as a Mandatory State, would have to refer such agreements back to the League of Nations.

IBN SAUD, RULER OF ARABIA.—The chief power in Arabia today is Ibn Saud, leader of the powerful Wahabi element among the Moslems and ruler of central Arabia. Having captured Mecca and forced the abdication of Hussein, King of the Hedjaz, Ibn Saud has since forced Hussein's son Ali to evacuate Jiddah, the port of Mecca. Ibn Saud is now practically master of Arabia. He is on friendly terms with the British in Iraq, who seek only

to prevent efforts on his part to oust the sons of Hussein, Faisal, and Abdullah, from the thrones of Iraq and Transjordania. The conference for the election of a new caliph of Islam will be held under his auspices in Arabia this year, and as an independent sovereign and master of the sacred cities of Mecca and Medina, he is the most powerful claimant for this position of religious leader of the Moslem world.

FAR EAST

BLOCKADE OF PEI-HO.—In March the Kuominchun (National Armies) under Feng Yu-hsiang, engaged in defending Tientsin against the attacks of Chang Tso-lin, mounted some artillery in the old Taku fort at the mouth of the Pei River leading to Tientsin, mined the river with "large dark objects" (reported later to be dummy mines), and proceeded to fire on neutral shipping attempting to enter the river. On March 19 they fired on two Japanese destroyers, killing an officer and wounding nine men. The fire was not returned. Subsequently the several powers which were parties to the Protocol of 1901, providing for an open waterway to Tientsin and Peking, called upon the Chinese government to remove the mines and lift the blockade under threat of joint naval action. Chinese observers believed that the action of the Japanese destroyers was intended to support the attacking forces under Chang Tso-lin.

FALL OF TIENTSIN.—On March 22 the city of Tientsin was evacuated by the Feng forces, which retreated north and without attempting to protect Peking. At the time of Chang Tso-lin's recapture of Tientsin, the forces of Wu-Pei-fu were reported to have crossed the Yellow River and to be pressing northward driving the National Army before them.

JAPANESE SUPPORT OF CHANG TSO-LIN.—According to a report of Thomas F. Millard, published in the *New York Times* of January 14, the downfall of the rebellion against Chang Tso-lin in Manchuria last December came largely through the intervention of Japan. At the critical moment in the rebellion, according to this report, Japanese police protected Chang's residence in Mukden, Japanese troops from Port Arthur were brought to Mukden and joined Chang's forces, and Chang's son was provided with funds to purchase the loyalty of Chang's leaders at Tientsin. This support brought about the collapse of the rebellion and the death of the rebel leader Kuo.

Chinese Trade.—According to the February *Living Age* tariff autonomy in China will favor American trade. Japan and the United States will be affected differently by Chinese tariff autonomy. For Japan exports to China large quantities of cotton-piece-goods and manufactures of a similar character which the Chinese can very well make in their own country; while the United States, which has lost most of its piece-goods trade to Japan, may expect an even greater demand than at present for machinery, iron and steel products, automobiles, and standardized metal-wares, in the production of which there is little likelihood that Japan can compete with us. In other words, the industrialization of China promises to increase the market for de-

velopment goods which America is now supplying, while it will decrease the market for consumption goods, which are more largely produced by Japan and Europe.

INCREASE OF POPULATION OF AUSTRALIA.—According to a report in the *Living Age* for February, the population of Australia has passed the six million mark, and has increased one-sixth in the last eight years. Two-thirds of this increase is due to excess of births over deaths, and one-third to immigration, which comes mostly from the British Isles, though there is a considerable influx of Italians, especially into the sugar cane country.

LATIN AMERICA

TACNA-ARICA PLEBISCITE.—(From Baltimore *Sun*, March 28.)—Arica, Chile, March 27.—Paradoxical conditions prevail here with regard to the plebiscite question, which it was believed had finally been referred to Washington.

The problem confronting the plebiscitary commission now is whether to suspend activities here pending the outcome of negotiations for a direct settlement between Chile and Peru, which would conform to the wishes of both the United States, as arbiter, and Peru, or to go on with the plebiscite preliminaries, as demanded by Chile.

Meanwhile the prospective voters of Tacna and Arica, the disputed provinces, proceeded to register today, but with only American and Chilean registration board members present. The Peruvian members had been ordered by their country's representative to abstain from participation in the registration activities.

On the other hand, a meeting of the Plebiscite Commission has been called for tomorrow, at which time it will be decided just what will be done here while Chile and Peru try to effect a direct settlement in Washington.

MEXICAN LAND REGULATIONS ACCEPTABLE.—The regulations which, according to Mexican practice, must be published to give effect to the new Mexican oil and land laws, were made public at the close of March and forwarded to the United States. After careful study, the American State Department reached the conclusion that these regulations offer a satisfactory solution of the controversy between the United States and Mexico.

Article 18 of the regulations definitely declares that the law shall not be applied retroactively.

BOOK REVIEWS

BOOK DEPARTMENT

The Institute Book Department will supply any obtainable naval, professional, or scientific book at retail price, postage prepaid. The trouble saved the purchaser through having one source of supply of all books should be considered. The cost will not be greater and sometimes less than when obtained direct from dealers.

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THE LIFE AND LETTERS OF REAR ADMIRAL STEPHEN B. LUCE. By Rear Admiral Albert Gleaves, U. S. Navy. G. P. Putnam's Sons. New York. London. $4.00.

REVIEWED BY REAR ADMIRAL S. A. STAUNTON, U. S. NAVY, RET.

Admiral Gleaves has done a service of unusual value to the Navy, and to all Americans, whether belonging to the Navy or not, who are interested in its history, value its traditions, and deem its development in accordance with that history and those traditions as essential to the future security and welfare of the country, by writing this excellent biography.

The book is admirably done. The personality of the distinguished officer, whose life and work are presented—that attractive appearance, mentality, charm and humor—which made him a hero to young men, and a leader to all, is never lost sight of; yet woven through the purely personal narrative, and made an essential part of it, is the story of his life-long efforts to make the Navy a better and stronger service and his final success in those efforts.

To those who, like myself, came under Admiral Luce's influence during their early naval days, the interest of the book is exceptional. When my class entered the Naval Academy in 1867, Commander Luce was Commandant of Midshipmen, a figure always military, keenly critical of any failure to meet military standards in manner, attitude, neatness or precision of dress, yet withal tolerant of the exuberance of youth, witty, and kind. His Sunday inspections had a searching quality all their own. He was somewhat feared as was natural and proper; but this fear was merged in admiration and the sincere liking that flows from admiration. My class had one year under his discipline at Annapolis and one practice cruise; and I think that all its members would agree as to the advantage of having that early formative period under such efficient direction and example.

But this is the personal interest felt by a number of people and for a number of years only, whether more or less is relatively unimportant. Admiral Luce's great service to the Navy lies in the construction work

secured largely through his efforts, the benefits of which have been and will continue to be of essential value to its efficiency; and recognized as such by future generations.

The first of these was the training of seamen. Before this was established and its influence upon the service substantially felt, the type of American man-of-war sailor was the "beach comber." There were those who were not of this type, but hardly enough to leaven the lump. We older officers all remember the type—gallant, brave, loyal, good sailors aloft, but victims of drink—reliable in the absence of alcohol, but unreliable in its presence—men who had spent their lives at sea—often in the worst conditions of merchant marine service—who had no traditions of home, no trace of home influence, many of them foreigners.

Then came the new order. American boys brought up in American homes, went to a training school where the best available influences were thrown about them and, after a period of instruction and discipline went into service afloat carrying with them the influence of the training school imposed upon that of their childhood. The change in the service was remarkable. Many of these men never drank. When they went ashore a saloon was not their first object. They wanted to see something of interest and value. I saw twenty years ago a large body, several hundred blue jackets, from the squadron in which I was serving, following one of the chaplains about over the acropolis at Athens and listening to his descriptions of the monuments and glories of ancient Greece. Observers—not Americans but foreigners—thought it a most remarkable thing for sailors to do.

That was the training system; and a remarkable illustration of what it was doing for the mental and moral betterment of seamen.

The establishment of the War College—the placing of it after many vicissitudes upon a permanent basis—is the other great achievement. It is well named. It is not a post graduate school for carrying to a higher degree the instruction received at other schools; but is essentially a school for discussion and determination of the art of naval warfare under all its known phases and contingencies, which is accomplished by a careful study and analysis of the history of naval warfare. The ordinary naval routine in time of peace does not lend itself to the study of war. It is often laborious and absorbing to an extent that leaves neither time nor disposition for other effort not immediately necessary. But when a group of officers, relieved from other duties, is ordered to the War College, to study the probable operations of war, a situation of great interest and advantage is opened. A genius for war, naval or military, needs no college. His reading and interpretation of history, his study, his intuition, all in fact that genius involves, is amply sufficient. But such are few; and while a genius needs no further training, those of lesser knowledge and ability, greatly need guidance and assistance at conferences where war is discussed.

Therefore the naval war college is an important—perhaps the most important single feature of the naval establishment—and as the instrumentalities of warfare are constantly changing, it is of equal importance that it should be continued to determine their application to and influence upon the

art of war. When the United States entered the World War, an officer of the Navy Department said that "Convoy was not debated. We shall not convoy." The mental foreground was occupied by the submarine, and a group of transports under convoy was regarded, and quite naturally, as offering the submarine its greatest opportunity. But the depth bomb changed all that, and made attack upon a convoy guarded by destroyers too dangerous to risk. This is an illustration of changes in war methods which make its constant study imperative.

Fame has often rested on lesser accomplishments than the establishment of the naval training system and the naval War College. These achieved through sound conceptions, determined and persistent effort, finally successful against prejudice and ignorance, form a substantial title to admiration and esteem. To these achievements of Admiral Luce, Admiral Gleaves has created a literary monument of value.

BLOCKADE RUNNING DURING THE CIVIL WAR, AND THE EFFECT OF LAND AND WATER TRANSPORTATION ON THE CONFEDERACY. By Francis B. C. Bradlee. Publication of the Essex Institute, Salem, Massachusetts. $7.50.

REVIEWED BY THOMAS G. FROTHINGHAM, CAPTAIN, U. S. R.

This is another publication of the Essex Institute which is of great value. The study of the blockade of the Confederacy has taken on a new interest since the lessons of the Civil War have been confirmed by the World War. On land and on sea, the strategy, tactics, and weapons, of the Civil War dominated the World War to such an extent that the four years of American warfare from 1861 to 1865 must be regarded as epoch-making. This was especially proved to be true in regard to the influence of the Civil War upon the problem of the Entente Allies for the blockade of the Central Powers. After the failure of other efforts, a successful blockade was only obtained by applying the doctrines of the blockade of the Civil War.

It was not alone by fighting battles that the Confederacy was overcome. The Southern states were actually besieged by a constricting envelopment, which at last strangled all resistance. Mr. Bradlee has well expressed this on an early page of his book: "Consider for an instant what would have happened to the North if the blockade of the southern coast—from Norfolk, Virginia, to the Rio Grande in Texas, nearly three thousand miles in length, and some of it being of the worst and most dangerous coast line in the world—had not been successful? Supposing that the blockade had been loose and inefficient, that instead of slowly but surely strangling the Confederacy to death, it had permitted cargoes of arms, military stores, food, and even recruits from foreign countries, to pass?"

In fact the main naval problem for the Federals was this blockade, made all the harder by the new definition in the Declaration of Paris, "A blockade to be legal must be effective." What the United States Navy accomp-

lished was no "cabinet blockade," but an actually "effective" blockade such as the world had never seen before. Our Navy had not ships enough to carry out this exacting task, where harbors and inlets gave every advantage to the blockade runners, but, with characteristic energy, all kinds of craft were utilized.

At first the blockade was *de facto*, as different portions of the coast line were policed and notifications of blockade issued. But, in an astonishingly short time, the blockade became "effective" along the whole coast line, and after the first six months there was no question of its legal status. But this was only the beginning of the undertaking. Great profits offered strong inducements for blockade runners, and running the blockade became a business much in fashion. This traffic passed through four stages; first, direct runs to and from Confederate ports: second, breaking the voyage by touching at a neutral port; third, actual trans-shipment at a neutral port; last, by shipment to a neutral port for shipment to the South. These were successive moves for evasion, as the blockade grew more strict.

It was in relation to the use of neutral ports that the United States established the two principles of blockade, which became the foundations of the blockade in the World War. It was upheld that the evidence of the character of the cargo and its ultimate destination made it liable to seizure—the doctrine of the "continuous voyage." And the normal consumption of a neutral community was held to be the measure of goods to be imported into that community—the so called "rationing policy" of the World War.

The narratives and the many good illustrations in Mr. Bradlee's book give a vivid picture of all stages of blockade running, and reflect the complicated task the United States Navy had set for itself in stopping the practice. As Mr. Bradlee has stated, "these blockade running ventures involved large investments of capital," and his list "showing the name of every blockade runner which ran in or out of Charleston" is a convincing proof of the "immense capital invested in the business." These steamers were the ocean greyhounds of their day, as will be evident from the many pictures of them in this book.

Yet this list also shows one means by which the United States Navy caught them—by fitting out captured blockade runners as armed United States cruisers to chase their former associates. The third name in this Charleston list is the steamer *Margaret and Jessie*, which was captured and taken into the Navy as U.S.S. *Gettysburg*. The end of the career of a blockade runner was thus described by one on board: "The chase lasted until half-past one in the afternoon, when a shell from the cruiser on our starboard beam called the *Gettysburg*, formerly the blockade runner *Margaret and Jessie*, struck us below the water line, making a large hole through which the water rushed like a mill stream"—a clear case of poetic justice. The fifth ship in the Charleston list of blockade runners, the steamer *Ella and Annie*, became U.S.S. *Malvern*, and there were many other instances of the same use of captured ships. The very ship which received her *coup de grace* from the *Gettysburg*, the steamer *Lilian*, was taken into the United States Navy.

The adventures of these blockade runners make a story of stirring events and the inducements of this exciting traffic brought out to command them men of high standing and of great ability. One of the most noted of these captains was Commander J. N. Maffitt, C.S.N., who had been in the United States Navy before the outbreak of secession. Commander Maffitt alternated blockade running with the command of C.S.S. *Florida*, one of the Confederate commerce destroyers. Many other officers of the Confederate Navy served on blockade runners. In fact their Navy and their Government were concerned in this traffic, and special steamers were built for it, through their Treasury Department as well as by private parties. The picture of the *Lizzie*, built on the Clyde in 1864, shows an extreme design for speed surprising in those days.

But, in spite of all efforts, the United States Navy won its fight in the blockade—and Mr. Bradlee in his last lines on the subject has summed up the case: "Even with all these drawbacks, the blockade became closer as time went on, and finally succeeded in commercially throttling the South to death, contributing quite as much to the final issues as the victories of the Union armies in the field." No one will be able to dispute this verdict.

Very properly, as an adjunct to his account of the blockade, Mr. Bradlee has incorporated a very comprehensive review of "the railroads and the Confederacy." His first paragraph is interesting: "The importance of the railroads to both sides during the Civil War has never been properly estimated. Had it not been for the 'iron bands' which connected the Northern and Western states (the trunk lines had only been completed a few years when the struggle began), slavery or no slavery, the latter would have followed their natural commercial outlet, the Mississippi, Ohio, Missouri, and other large rivers, and would have thrown in their lot with the Confederacy. This is rather a large "if"—but Mr. Bradlee's very earnest development of the story of the railroads in the Civil War is well worth thoughtful reading. Its real value consists in describing the help to the South of the railroads, for "the single advantage in the game of war which it enjoyed. By means of its geographical situation the Confederacy occupied 'interior lines,' and could reenforce from one flank to the other, across the country, more quickly than its enemies could discover and follow such movements by roundabout routes."

Mr. Bradlee has also added an account of the Confederate Post Office Department, the Telegraphs and the Confederacy, and the Southern Express Company during the war.

JANE'S FIGHTING SHIPS, 1925. Edited by Oscar Parkes, O.B.E, M.B., Ch.B., and Francis E. McMurtrie, A.I.N.A. Sampson Low, Marston and Company, Ltd., London. Price in London, 42 S.

Although this book was reviewed in the February, 1926, issue of the PROCEEDINGS, it is believed that the following additional comment should be made:

The February review suggests that an error has been committed in entitling the 1925 edition the 29th, and remarks that the first edition appeared in 1898. As a matter of fact, the first edition actually was published in the autumn of 1897, though in many of the copies the date 1898 appears on the title page. A second edition was brought out about the middle of 1898, so described on the title page, a fact of which very few people appear to be aware. The confusion first arose with the 1899 edition, which, for reasons which are no longer ascertainable (owing to the death of Fred T. Jane in 1916), was ascribed as the "second year"—possibly because less than three full years had elapsed between its issue and that of the first edition. As time went on, however, the publication date approximated to the period of the year in which the first edition appeared, so that 1925 is unquestionably the 29th year in which the book has made its appearance.

Francis E. McMurtrie, one of the editors, is the authority for the above and states that Doctor Parkes and himself, after carefully checking the facts, did not have the jacket submitted to them before publication, so that it is in apparent disagreement with the title page.

H. A. B.

INTERNATIONAL ELECTRICAL COMMUNICATIONS

By Walter S. Rogers

Adviser to American Delegation Peace Conference, Paris, 1919.

Editor's Note: The Naval Institute wishes to acknowledge its appreciation to Mr. Rogers for his permission to publish this article.

My interest in trans-Pacific communication dates from the winter of 1916-1917 when I was in the Far East investigating the possibilities of selling American news to the Chinese and Japanese press. At the time but little American news was reaching the Far East and that little was handled by British, German, and Japanese news organizations. As a consequence foreign news organizations were largely determining the amount and character of news regarding the United States reaching the Orient and, also, to a considerable extent, the amount and volume of news regarding the Orient reaching the United States.

Let me illustrate with a case: When President Wilson's important Lusitania note was made public, a British news agency sent throughout China those portions of the note peculiarly to the liking of the British; A German organization distributed those portions least objectionable to Germany. One Chinese newspaper in bewilderment printed the versions in parallel columns and asked: What did the President really say?

As a matter of fact a British news agency—Reuter's—has for a great many years largely dominated the world news going in and out of the East. Although there are a number of reasons why direct news services between the United States and the Orient have not been extensively developed, perhaps the principal reason is, and has been, the relatively high rates charged for press messages transmitted across the Pacific.

It is not my intention to get into a discussion of the highly complex questions involved in the world-wide collection and distribution of news—not even into a detailed consideration of problems involved in the handling of news across the Pacific.

I think that we can readily agree that American news, general and commercial, should be widely distributed throughout the Pacific area and that news from our outlying possessions and from the various foreign countries should be available to the American press in generous quantities. Such news, both incoming and outgoing, should in the main be handled by Americans. We should not be at the mercy of foreign news agencies or of foreign governments.

The existence of such news services, in the absence of government news services or of subsidized services, will largely depend upon there being satisfactory communication services handling press messages at low rates. Satisfactory facilities and services between the United States and other countries are not likely to be provided by foreign companies or foreign governments.

There should be a wide range of facilities, the layout being such that even in war time services can be in large part maintained and be free from an unfriendly censorship. For example, it may be vitally important at some time for American news to be reaching the Chinese press. There can be no certainty of this, if the communication services between the United States and China are controlled by adverse interests.

During the World War I built up and had charge of this government's world-wide telegraph, cable, and radio news services, services that played a large part in getting the American story to the people of the world.

It so happened that my offices in New York were alongside those of the naval censorship. Gradually I was drawn into the consideration of many of the censorship problems. Prior to the World War censorship was looked upon primarily as a device to prevent the transmission of military information. During the course of that war, however, the censorship gradually became a device for exercising economic control. Through control over the means of communication, increasingly effective control was exercised over world markets, over movements of goods, and finance. Messages were scanned for information regarding goods and money, and were suppressed or delayed as seemed desirable.

Obviously the effectiveness of such control or conversely the freedom from such control depends in large part on the degree to which a given belligerent is in position to supervise the main communication channels of the world.

If you will study a cable map, you will see that the English are very advantageously situated with regard to control of cable traffic—infinitely better situated than the United States. The British situation is due in part to the number, the mileage, and location of British-owned cables and in part to the fact that many other cable systems have been developed in such ways as to be dependent in one way or another on the British-owned cables. For example, the Western Union operates a cable from Miami to the Barbadoes where it connects with a British cable system operating rather generally in South America. In a sense the Western Union cable merely provides an entrance into the United States for the British system.

The British cable systems enabled that country not only to mobilize promptly the material, personnel, and public sentiment of the empire, but to maintain throughout the war unity of action.

As you are well aware, modern naval operations and military operations abroad are largely conditioned by the availability of suitable and dependable communication services—telegraph, cable, and radio. The significance of communications in modern warfare is of course too big a subject to deal with as part of a general discussion. In any event, officers of the signal corps and of naval communications know infinitely more about than I do.

There are, however, two or three relevant points that may well be made. Major communication facilities, such as long-distance submarine cables and high-powered radio stations, can not be easily provided after hostilities have commenced. The construction problems are serious and often concessions cannot be obtained.

Where possible, communication facilities should be developed so as not to be dependent upon other countries. Many of the British cables touch only British soil, and the British have long been considering plans for an empire-wide radio system.

In addition to the provision of cable and radio systems connecting the scattered parts of an empire, it is also desirable to establish in peace time the widest possible range of communication contacts, cable and radio, with countries likely to be friendly.

There are distinct diplomatic and political aspects to communications. I will mention but two or three. The State Department needs for its purposes the best possible communication contacts with the principal capitals of the world. The contacts should be such that they are not likely to break down at times of crises and should be under such control that they can be trusted—that messages will not be copied and placed in the hands of rivals. Geneva, for example, from a communication point of view, is unfortunately situated for this country. Messages between the State Department and American representatives at Geneva must traverse European countries.

News as a factor in international relations has been referred to. A generous exchange of news between the scattered parts of a country is peculiarly important. There certainly should be adequate news communication services between the United States and its outlying possessions.

For years many leaders in British life have believed that the empire should be linked together by means of cable and radio, transmitting news at low rates. They believe that the continued unity of the empire is dependent upon the steady improvement of such services, that in future the empire must be held together by common ideas and purposes.

It is seemingly impossible to determine the precise part that international communications play in trade and finance. A professor here in Washington is working on a book in which the subject will be touched upon. Without the professor's book, it is apparent that a country enjoying good services at relatively low rates possesses an advantage over a commercial rival less well served. Germany as she developed a navy, a mercantile marine, foreign trade, and colonial possessions, found it necessary to provide communication services.

If it is considerably cheaper to communicate between Western Europe and China than it is to communicate between the United States and China, surely European traders have a valuable advantage.

Let me gather up things a bit; all that I have been trying to say is that a wide range of communication contacts, uncontrolled by outsiders, is desirable from many points of view—military, political, diplomatic, social, and economic.

With this in mind let us turn to the trans-Pacific situation. I am not going into details, but intend to touch merely a few of the high spots.

Curiously enough, the history of communications in the Far East begins with the failure of the first trans-Atlantic cable. There was an immense interest in this project, almost as great a popular interest as there now is in radio. When after the transmission of a few hundred messages the first trans-Atlantic cable went dead, many people concluded that no cable of such great length could ever be successfully operated. This belief and general interest in communication between the United States and Western Europe led to a plan for a telegraph system by way of Alaska and Siberia. A company was organized, concessions were obtained and several million dollars spent on the undertaking. It was abandoned, however, when the second and third trans-Atlantic cables proved successful.

The project had aroused great interest in Russia and stimulated the extension of the Russian telegraph system to the Pacific. This extension was followed by the laying of cables in the Far East.

In 1871 a Danish company, in which the Russian imperial family was interested, laid cables connecting Vladivostok, Nagasaki, Shanghai, and Hongkong. In the same year a British company, whose cable system had been gradually extended eastward until Singapore had been reached, laid a cable from that place to Hongkong. Neither company had any very definite permission to operate in China.

The British company is part of the great British cable combine known generally as the "Eastern." The Danish company, the Great Northern, operates in Europe as well as the Far East and is perhaps the largest commercial enterprise controlled by Danes.

In the early days the two companies were rivals, but in due time they entered into an offensive and defensive alliance. Like all public utility companies they sought to secure a monopoly. Whenever efforts in that direction came to the attention of the American Government—there were several such occasions—the American Government protested on the grounds that a cable monopoly would be detrimental to the interests of China and in violation of American treaty rights. Much can—and has—been said on both sides of these contentions.

As a result of certain agreements secured in 1900, and reaffirmed in 1913, the two cable companies claim a monopoly over Chinese external communications until the beginning of the year 1931.

The agreements were negotiated in secret and, as far as possible were kept secret. The dates are significant. The first agreement is dated August 4, 1900, at which time the foreign legations were being besieged in Peking. The second agreement is dated October 27, 1900, at which time an Allied military force was in occupation of Peking. China for months had been in chaos. And it is difficult to conceive of any Chinese official or body in position to grant such sweeping rights. Nevertheless they were granted.

It is not to be wondered at that the companies took advantage of the unsettled conditions in China to secure a monopoly. But the British Government was involved. There is good evidence that the British Government, at the very least, knew what was going on, although at the same time the Allied powers were presumably acting together and in good faith. The cable monopoly, and particularly the share the British Government took in securing it, have long been a sore spot in Anglo-American relations. But bluntly the British Government double-crossed the American Government. Diplomatically the British and American governments were cooperating with respect to China; behind the scenes a British company was securing rights detrimental to American interests. Despite the protests of the American Government, the British Government had steadily supported the British company in its assertion of a monopoly.

There were reasons why both the company and the British Government were especially anxious that the monopoly be secured. With the acquisition by the United States first of the Hawaiian Islands and then of the Philippines, it became apparent that a trans-Pacific cable was inevitable. Such a cable had been talked of for many years.

In 1899 President McKinley sent a message to Congress calling attention to the need for such a cable. In 1900 and 1902 committees of Congress gave consideration to the matter.

The cable companies were animated by ordinary commercial self-interest. They did not want competition. In the absence of a trans-Pacific cable, traffic between the United States and the Orient would continue to go by way of Europe and the companies' lines.

The British Government was concerned with the fact the United States was likely to play in future an increasingly important part in the Far East. The acquisition of the Philippines and Guam had given the American Government an additional stake, and the American Government at the moment was actually taking an important part. The American Government was advocating the territorial integrity of China and was urging general acceptance of the Open Door policy.

A trans-Pacific cable would serve to extend America's influence in the Far East. The problem, confronting the British, was either to prevent the laying of a trans-Pacific cable or to have it laid under such conditions that it would be largely ham strung.

When, as a result of President McKinley's message and the attitude of Congress, it seemed that a government-owned or aided cable was likely, an American company announced that it would lay a trans-Pacific cable and would not ask a subsidy. Upon this announcement Congress dropped the matter. It did not turn out until years later than the alleged American company was really a dummy concern in which one-half of the stock was owned by British cable interests, one-quarter by the Danish, and only one-quarter by Americans. In addition the American company gave to the British and Danish cable companies several millions of dollars in bonds in consideration of their permitting their own creature to land and do business in China.

It is difficult, of course, to characterize the activities of any commercial enterprise. But in my judgment the trans-Pacific cable has on the whole been operated not in American interests, but with a view to protecting the interests of the British and Danish cable companies. One result has been to favor British trade in the Far East as against America. I have at various

times made similar statements in public—much to the horror of the officials of the cable company. But I think the facts fully support the statements.

Just as for years there had been discussion of a cable to cross the North Pacific, there had been discussion of a cable to connect Canada with Australia. The British cable company that secured the monoply in China fought the laying of a Canada-Australasia cable. Although successful in getting a north Pacific cable to their liking, they did not succeed in preventing the laying of an independent cable between Canada and Australasia. Moreover, this cable was provided by Great Britain, Canada, Australia, and New Zealand. And has since been operated by a board representing the mother country and the dominions.

The north-Pacific cable and the "All Red" cable, as it is sometimes called for it touches only British soil, were laid at about the same time, roughly are of the same length, and roughly represent about the same cost. The "All Red" cable system has been run for the benefit of the British Empire; the trans-Pacific cable has been run—well it is not easy to say for whose benefit. A comparison of the services, rates, and attitudes of the two cables is most enlightening.

The Chinese cable monopoly has prevented the laying of a competing cable across the North Pacific and has prevented the development of direct commercial radio communication between the United States and China.

There are several Chinese radio agreements. The more important are:

In 1918 a contract and certain supplemental agreements were made by the Chinese Ministry of the Navy and the Japanese firm of Mitsui Bussan Kaisha for the construction of a radio station in the neighborhood of Peking capable of direct communication with Japan, America, and Europe. A provision in one of the supplemental agreements confers a monopoly for thirty years over radio communication between China and other countries, and between China and ships at sea.

Reference is made to the cable monopoly, the idea apparently being that either the Mitsui would come to some amicable arrangement with the cable companies or the radio station would not be used to compete with them until the expiration of their monopoly.

Early in 1921 an agreement was entered into between the Chinese Minister of Communications and an American company, the Federal Telegraph Company of California, providing for the construction and operation of a high-power radio station capable of communication with the United States and of certain secondary stations. The agreement, which has since been modified, is complicated and not easy to summarize. Reduced to lowest terms it provides both for the construction of stations for the account of the Chinese Government and for their operation for a period of a year by a "China-Federal Radio Administration," representative of both the government and the company. The agreement, with the consent of the Chinese Government, has been transferred to the Federal Telegraph Company of Delaware, in which the California company and the Radio Corporation of America are interested, with the latter predominating.

The British, Danish, and Japanese governments, acting in behalf of their respective nationals who claim exclusive or preferential rights, have protested vigorously against the Federal Agreement and have used their influence to prevent its being carried into effect. The American Government has given diplomatic support to the Federal, insisting that the monopolistic provisions are violative of American treaty rights and of the principle of the Open Door.

The opposition has, thus far, been sufficiently strong to prevent the erection of the Federal stations. In the American view, China in not carrying out its part of the Federal agreement in not living up to its legal and moral obligations. The station provided by the Mitsui agreement has been erected but does not handle trans-Pacific traffic.

The subject of trans-Pacific communication—what was really meant was the controversy over the Chinese concessions—was on the Agenda of the Washington Conference for the Limitation of Armament, but for a variety of reasons was not taken up for definite consideration. A suggestion was made to the American delegation that certain British, French, American and Japanese radio interests be permitted, working in conjunction, to develop Chinese high-power radio, but the suggestion did not meet with American approval. M. Viviani offered a resolution covering substantially the same idea. It was side-tracked.

Immediately following the Conference, representatives of Great Britain, France, Japan, and the United States, acting informally, undertook to devise a scheme that would iron out the conflicting interests and would be fair to the commercial interests concerned and to the public. While the representatives agreed upon a plan, nothing much has come of it.

One reason why nothing much has come of the plan is that the Federal Company declined to accept it as a basis for an all around settlement. It so happens that I represented the United States at the informal conference. In my opinion the State Department had nursed the Federal Company to the point where it expected support under almost any circumstances. It believed that, aided by the American Government, it could bull through its program.

When it became apparent that the Federal concession might be considered at the Arms Conference, the president of the Federal Company was sent for and asked point blank whether the company was assured of sufficient financial support to develop its concession. Assurance to that effect was given. Nevertheless, only a short time after the Conference adjourned, his company admitted that it could not raise the necessary funds. Furthermore the president, the representative of the company, the man who had secured the concessions, later on lost control, and was ousted.

Inability of the Federal Company, a California concern, to raise needed funds led to a deal between that company and the Radio Corporation whereby the Federal of California and the Radio Corporation set up a new company, the Federal of Delaware, to which in due time the Chinese concession was transferred. The fact that the Radio Corporation dominated the new company materially changed the situation. The Radio Corporation seeks a monopoly of American radio communication with other countries. One of the grounds for supporting the Federal was the hope that it would develop as an independent competing American radio telegraph organization.

The proposal drafted by the informal conference of British, French, Japanese, and American representatives recognized the principle that radio communication between China and the United States should be owned and conducted by Chinese or Americans or both and that no outside interest, government or commercial, should be allowed to participate or to straddle such communication. In my judgment this is a sound principle. Where would we be were the Chinese end owned by British, French, or Japanese singly, or together, or even in partnership with Americans? Where would we be if radio messages between China and the United States were relayed through Japanese stations?

Perhaps it will be well at this stage to block out roughly the present situation:

1.) There is one cable across the North Pacific. It is old and of an obsolete type. In my opinion, at least, it has not had any too creditable a career.

2.) British and Danish cable interests have a monopoly over Chinese external communications running until the beginning of the year 1931.

3.) There is a government-owned and operated cable connecting Canada and Australasia that touches only British soil and is, therefore, under complete British jurisdiction. It is in the course of being duplicated. It is operated with a view to serve British purposes.

4.) The Radio Corporation operates a radio circuit connecting the United States and Japan.

5.) The Radio Corporation dominates the company now holding the Federal Chinese radio concession. As a result of opposition on the part, principally, of Great Britain and Japan, the Federal concession has thus far not been developed. Negotiations in regard to it have been going on in Peking for years.

6.) There are certain other Chinese radio concessions, the really important one being the Mitsui, under which claim is made to a monopoly over Chinese external radio communication. The Mitsui station has been erected.

7.) The American Navy has an extensive radio system in the Pacific but its employment for general communication purposes is strictly limited by statute.

8.) The former German cables, Menado-Yap, Yap-Guam, and Yap-Shanghai, were seized as part of the spoils of war. The United States, Japan, and the Dutch governments have agreed to divide the cables, but the agreement has not been ratified by the other countries claiming an interest in the German cables.

I think one will be disposed to agree with me that the present situation with respect to trans-Pacific communication is far from satisfactory if viewed in the light of American political, commercial, press, or military interests. Certainly for strategic reason there should be additional cables, suitably located, and at least there should be radio communication between the Philippines, Guam, the Hawaiian Islands and other American territory and China, with the Chinese stations in control of Americans or at least of interests likely to be friendly.

What can be done to improve the present situation? Let us consider some of the interests involved. Certainly what the Japanese desire is to control as far as possible communication contacts between China and the rest of the world, particularly communication between the Far East and the United States. Japan certainly wants low rates between Japan and China and high rates between China and Western Europe or North America.

Certainly Great Britain can be expected to support her cable and radio companies, and to look after British interests generally. It is reasonable to assume that Great Britain has no desire to have American commerce, American prestige, American military strength develop in the Far East, and this naturally inclines the British to opposition to the development of American communication facilities and services in the Far East.

The French interest is not quite so clear, but in any international activity in respect to communications it will come out that France is alertly concerned with radio communication between France and Indo-Chino, and with holding on to the radio station now in the French concession at Shanghai.

The American cable and radio interests are concerned with making money and only incidentally with American commercial, political, press, and military interests. The American companies are not free agents in regard to trans-Pacific communication for they are involved in relationships with foreign governments and foreign communication companies not only in the Pacific area but in other parts of the world. American cable companies are largely dependent upon the good will of the British Government and of the British cable companies. The Radio Corporation is involved in complicated arrangements with foreign governments and foreign companies.

The American companies seek to avoid as far as possible regulation, either as a result of action by the American Government or as a result of international agreement. Above all, they seek to avoid competition with government-owned facilities.

American business organizations occasionally adopt resolutions that urge better services and rates, but there is no evidence of a general realiza-

tion on the part of American business of the desirability of constant extension and improvement of international communication contacts—and there certainly is no evidence of a willingness to make a concerted drive to secure them.

The American newspapers and press associations have a cable committee. It does much useful work. But I doubt if the members of the committee are likely to become "het up" over communication needs in the Pacific.

Now, for reasons which I need not elaborate, I do not think that private enterprise, left to its own initiative, is likely to provide for the Pacific area the communication facilities and services needed. Certain additional services that look attractive from a money-making viewpoint will be provided. It was from a feeling that there are some jobs that private enterprises can not do, or at least is unlikely to do, that led Great Britain, Canada, Australia, and New Zealand to join in providing a Canada-Australasia cable. It was from this same feeling that Congress provided for a government cable to Alaska.

Only recently the head of one of the American cable companies, not of the company now operating in the Pacific, stated to me that the only solution to the Pacific cable situation was the provision of government-owned cables leased for operation to the cable companies on such terms as would stimulate the companies to develop traffic. Incidentally, in 1902, a then vice-president of the Western Union suggested to a committee of Congress a government-owned trans-Pacific cable leased for operation.

In the Pacific, as elsewhere, radio is providing competition with cables. Seemingly on the great trade routes, the history is going to be: first the radio rates will be fixed low enough to attract traffic; then, in due time, the cable and radio interests will get together and agree on rates. Competition so far as rates are concerned will end. I haven't the slightest doubt that in due time there will be pretty complete agreement between the great cable and radio interests of the world.

The American Army and Navy have done very remarkable work in developing communication facilities in the Pacific. But I doubt if they can secure money for additional major developments. In any event it is quite unlikely that either the Army or Navy can secure concessions for the location and operation of cables or radio on foreign soil. Moreover, whatever additional facilities the Army and Navy succeed in providing, in view of the power of the commercial communication interests and of the prevailing official attitude in opposition to government participation in business, it is unlikely that permission will be granted for wide use of such facilities for the transmission of press and commercial messages.

The forces at work and the conflicting interest are such that it is difficult to see just how the Pacific area is going to be adequately provided with communication facilities providing services needful to the general interests of all concerned.

There are two things, it seems to me, that would be helpful: first, a broad survey of the whole Pacific area with a view to ascertain precisely what are the communication needs—military, commercial, press, political, social; and secondly the advent of some outstanding person in a position of influence who will advocate and bring about the adoption of progressive action with reference to trans-Pacific communications. The exceptional situation as regards cables held by Great Britain is attributable in no small measure to a little group of men in Parliament who whimsically called themselves the "cable party." Year in and year out, they nagged the government departments, their fellow members of Parliament, the cable companies, and they got results.

It is fairly certain that, if the United States really had a program, Great Britain, Japan, China, and other countries could be persuaded to do their share in building up a really comprehensive and satisfactory cable and radio situation throughout the whole Pacific area—north and south.

INCORPORATION OF NAVAL HISTORICAL FOUNDATION

EDITOR'S NOTE: The Naval Institute paid to the Foundation under date of April 13, $1,000 as an initial contribution to the Trust Fund.

The organization meeting of the incorporators of the Naval Historical Foundation was held in the Navy Department, Washington, D. C., on Tuesday, March 23 at 2:30 P.M.

The following incorporators were present: Rear Admiral Austin M. Knight, U. S. Navy (retired), Dr. J. Franklin Jameson, Director of Historical Research, Carnegie Institution of Washington, Rear Admiral Elliot Snow, (C.C.) U. S. Navy, Captain Dudley W. Knox, U. S. Navy (retired),

Admiral Knight called the meeting to order.

On motion of Captain Knox, duly seconded, Admiral Knight was elected chairman of the meeting.

On motion of Admiral Snow, duly seconded, Captain Knox was elected secretary of the meeting.

The chairman reported that the certificates of incorporation had been duly executed, acknowledged, and recorded.

On motion of Captain Knox, duly seconded, the secretary was directed to spread upon the minutes a copy of the certificate of incorporation as follows:

CERTIFICATE OF INCORPORATION
OF
THE NAVAL HISTORICAL FOUNDATION

This is to certify that we whose names are hereunto subscribed, citizens of the United States, a majority of whom are citizens of the District of Columbia, have associated ourselves together, pursuant to provision of Chapter XVIII, Subchapter III of the Code of Law for the District of Columbia, approved March 3, 1901, and Acts of Congress amendatory thereof, under the corporate name of

THE NAVAL HISTORICAL FOUNDATION

by which corporate name or title said incorporated society shall be known in law.

The term for which the incorporated society is organized is perpetual.

The particular business and objects of the incorporated society are educational and literary, and, in the interest of American naval history and of the fostering of patriotism, the collection, acquisition, and the preservation either in its own possession or by transfer or gift to the United States Navy Department, libraries, historical societies or other similar institutions, of manuscripts, relics, books, pictures, and all other things and information

pertaining to the history and traditions of the United States Navy and merchant marine, and the diffusion of knowledge respecting such history and traditions either by publication or otherwise.

The number of trustees, directors, or managers of the incorporated society shall, for the first year of its existence, be seven in number who shall be known as the Board of Trustees.

Witness our signatures this 13th day of March, A.D. 1926.

CURTIS D. WILBUR
AUSTIN M. KNIGHT
HILARY P. JONES
GEORGE RICHARDS
J. FRANKLIN JAMESON
ELLIOT SNOW
DUDLEY W. KNOX

District of Columbia, ss.

I, Harry W. Smith a notary public in and for the District of Columbia, do hereby certify that Curtis D. Wilbur, J. Franklin Jameson, Austin M. Knight, Hilary P. Jones, Elliot Snow, and Dudley W. Knox, parties to a certain Certificate of Incorporation of The Naval Historical Foundation, bearing date on the 13th day of March, A. D. 1926, to which this is hereto annexed, personally appeared before me in the said District, each being personally known to me to be the person who executed the said Certificate of Incorporation and each acknowledged respectively that he executed the same as his free act and deed and for the purposes therein named.

Witness my signature and notarial seal, this 13th day of March A. D. 1926.

HARRY W. SMITH,
Notary Public

(NOTARIAL SEAL)

My Commission as Notary Public
expires on April 5, A. D. 1927

District of Columbia, ss.

I, Harry W. Smith a notary public in and for the District of Columbia, do hereby certify that George Richards, a party to a certain Certificate of Incorporation of The Naval Historical Foundation, bearing date on the 13th day of March, A. D. 1926, to which this is hereto annexed, personally appeared before me in the said District, being personally known to me to be the person who executed the said Certificate of Incorporation and acknowledged that he executed the same as his free act and deed and for the purposes therein named.

Witness my signature and notarial seal, this 13th day of March, A.D. 1926.

HARRY W. SMITH,
Notary Public

(NOTARIAL SEAL)

My Commission as Notary Public
expires on April 5, A. D., 1927

Office of the Recorder of Deeds,
District of Columbia

THIS IS TO CERTIFY that the foregoing is a true and verified copy of the Certificate of Incorporation of the Naval Historical Foundation, and of

the whole of said Certificate of Incorporation, as filed in this office the 16th day of March, A. D., 1926.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed the seal of this office this 17th day of March, A. D., 1926.

ARTHUR G. FROE,
Recorder of Deeds, D. C.

On motion of Captain Knox, duly seconded, the following by-laws were adopted:

BY-LAWS

1. The name of the organization shall be "The Naval Historical Foundation." Its principal office shall be located in Washington in the District of Columbia.
2. The objects of the foundation shall be "educational and literary, and, in the interests of American naval history and of the fostering of patriotism, the collection, acquisition, and the preservation either in its own possession or by transfer or gift to the United States Navy Department, libraries, historical societies or other similar institutions, of manuscripts, relics, books, pictures, and all other things and information pertaining to the history and traditions of the United States Navy and merchant marine, and the diffusion of knowledge respecting such history and traditions either by publication or otherwise."
3. The members of the foundation shall be
   a) The Incorporators
   b) Members of the Board of Trustees
   c) During the continuance of their respective offices
      (1) The secretary of the Navy
      (2) The assistant secretary of the Navy
      (3) The president of the U. S. Naval Institute and the members of its Board of Control.
      (4) The naval officer in charge of the Office of Naval Records and Library of the Navy Department, and other naval officers attached to said office.
      (5) The superintendent of the U. S. Naval Academy, the members of its Academic Board, the librarian, and the curator.
      (6) The president of the following societies, each of whom shall be requested to nominate for membership in this foundation some other member of the respective society, known to be interested in naval history
      The Naval History Society
      The National Society of the Sons of the Revolution
      The National Society of the Sons of the American Revolution
      The National Society of the Daughters of the American Revolution
      The General Society of the Daughters of the Revolution
      The U. S. National Society of the Daughters of 1812
      The Society of Sponsors of the U. S. Navy

d) Any other person elected by the Board of Trustees or by the foundation.

4. There shall be an annual meeting of the members called by the Board of Trustees. Special meetings of members may be called by the Board of Trustees on three weeks' notice and shall be called on the written request of twenty-five members. All meetings shall be held in Washington, D.C., except when the Board of Trustees specifically designates another place of meeting. Fifteen members shall form a quorum.

5. The Board of Trustees shall have the powers provided by the laws of the District of Columbia, and may make rules not inconsistent with said laws and with these by-laws. After the first year of incorporation, the Board shall have the power to increase the number of its members to not exceeding eleven. The incorporators of the foundation at the organization meeting, shall elect the first Board of Trustees to consist of seven members, four to serve for a term of three years, and three to serve for a term of four years. At the expiration of these terms of service, respectively, the term for which their successors respectively and any additional members shall be elected, shall be for three years. Any vacancy on the Board of Trustees may be filled by the Board until the next annual meeting of the members, at which meeting a trustee shall be elected by the members for the unexpired term.

6. The Board of Trustees may appoint an executive committee from among its members for such term as it may deem proper, not exceeding two years, and (except in cases which it is provided by these by-laws that the vote of the Board of Trustees must be unanimous) may delegate to it such powers as the Board may deem proper and as may be in accord with the laws of the District of Columbia.

7. The officers of the foundation shall be a president, a vice president, a secretary, and a treasurer, each having the powers and duties usually incident to his office. They shall be elected by the Board of Trustees from among its members and shall hold office for three years or until their successors are elected. The Board may elect other officers and prescribe their duties, and may combine the offices of secretary and treasurer in the same person.

8. No officer of the foundation or member of the Board of Trustees shall while remaining in office receive any compensation from the foundation.

9. The treasurer shall transfer capital fund donations and other capital funds to a trust company, selected by the Board of Trustees, as credits to a "Trust Fund," under a contract approved by said Board. Except by a written approval of three-fourths of the members of said Board, the capital of said Trust Fund shall not be expended.

10. The Board of Trustees may adopt a form of seal for the foundation.

11. These by-laws may be amended by the affirmative vote of a majority of members voting on the question at a members' meeting.

The incorporators then proceeded in accordance with the by-laws to the election of a Board of Trustees, with the following result:

Trustees for a term of four years

REAR ADMIRAL AUSTIN M. KNIGHT, U. S. Navy (retired).
DR. CHARLES OSCAR PAULLIN, Ph.D.
BRIGADIER GENERAL GEORGE RICHARDS, U. S. Marine Corps.

Trustees for a term of three years

REAR ADMIRAL WILLIAM L. RODGERS, U. S. Navy (retired).
DR. J. FRANKLIN JAMESON, Ph.D., L.L.D., Litt.D.
REAR ADMIRAL ELLIOT SNOW (C.C.), U. S. Navy.
CAPTAIN DUDLEY W. KNOX, U. S. Navy (retired).

At 3:45 P.M. the meeting adjourned.

DUDLEY W. KNOX,
Secretary.

The Naval Institute has been informed by the secretary of the Naval Historical Foundation that the Board of Trustees, at a meeting on March 30, 1926, elected the following officers of the Foundation:

President, REAR ADMIRAL AUSTIN M. KNIGHT, U. S. Navy (retired).
Vice-President, DR. J. FRANKLIN JAMESON.
Secretary, CAPTAIN DUDLEY W. KNOX, U. S. Navy (retired).
Treasurer, DR. CHARLES O. PAULLIN.

The executive committee of the Board was appointed, and consists of:

REAR ADMIRAL AUSTIN M. KNIGHT, U. S. Navy (retired).
REAR ADMIRAL W. L. RODGERS, U. S. Navy (retired).
BRIGADIER GENERAL GEORGE RICHARDS, U. S. Marine Corps.

The address of the foundation for the present is in care of the Office of Naval Records and Library, Navy Department, Washington, D. C.

The legal incorporation and organization of the Naval Historical Foundation is now complete. Anyone wishing to make contributions, either of money or of manuscript, books, pictures, relics, etc., possessing naval historical value, is at liberty to do so, and should address them to the "President, Naval Historical Foundation, Room 2728, Navy Department, Washington, D. C."

Due acknowledgments will be made and permanent records kept of all donations. Funds so received will be placed in trust. Historical material will be placed in such suitable public archives, libraries, or museums, as the Board of Trustees may select.

THE WASHINGTON TREATIES, 1922

EDITOR'S NOTE: The Washington Treaties are reprinted here for the convenience of the Institute's members and subscribers, in view of the approaching Conference at Geneva.

CHAPTER I

GENERAL PROVISIONS RELATING TO THE LIMITATION OF NAVAL ARMAMENT

ARTICLE I

The Contracting Powers agree to limit their respective naval armament as provided in the present Treaty.

ARTICLE II

The Contracting Powers may retain respectively the capital ships which are specified in Chapter II, Part 1. On the coming into force of the present Treaty, but subject to the following provisions of this Article, all other capital ships, built or building, of the United States, the British Empire and Japan shall be disposed of as prescribed in Chapter II, Part 2.

In addition to the capital ships specified in Chapter II, Part 1, the United States may complete and retain two ships of the *West Virginia* class now under construction. On the completion of these two ships the *North Dakota* and *Delaware* shall be disposed of as prescribed in Chapter II, Part 2.

The British Empire may, in accordance with the replacement table in Chapter II, Part 3, construct two new capital ships not exceeding 35,000 tons (35,560 metric tons) standard displacement each. On the completion of the said two ships the *Thunderer, King George V. Ajax* and *Centurion* shall be disposed of as prescribed in Chapter II, Part 2.

ARTICLE III

Subject to the provisions of Article II, the Contracting Powers shall abandon their respective capital ship building programs, and no new capital ships shall be constructed or acquired by any of the Contracting Powers except replacement tonnage which may be constructed or acquired as specified in Chapter II, Part 3.

Ships which are replaced in accordance with Chapter II, Part 3, shall be disposed of as prescribed in Part 2 of that Chapter.

ARTICLE IV

The total capital ship replacement tonnage of each of the Contracting Powers shall not exceed in standard displacement, for the United States 525,000 tons (533,400 metric tons); for the British Empire 525,000 tons (533,400 metric tons); for France 175,000 tons (177,800 metric tons); for Italy 175,000 tons (177,800 metric tons); for Japan 315,000 tons (320,040 metric tons).

ARTICLE V

No capital ship exceeding 35,000 tons (35,560 metric tons) standard displacement shall be acquired by, or constructed by, for, or within the jurisdiction of, any of the Contracting Powers.

ARTICLE VI

No capital ship of any of the Contracting Powers shall carry a gun with a calibre in excess of 16 inches(406 millimetres).

ARTICLE VII

The total tonnage for aircraft carriers of each of the Contracting Powers shall not exceed in standard displacement, for the United States 135,000 tons (137,160 metric tons); for the British Empire 135,000 tons (137,160 metric tons); for France 60,000 tons (60,960 metric tons); for Italy 60,000 tons (60,960 metric tons); for Japan 81,000 tons (82,296 metric tons).

ARTICLE VIII

The replacement of aircraft carriers shall be effected only as prescribed in Chapter II, Part 3, provided, however, that all aircraft carrier tonnage in existence or building on November 12, 1921, shall be considered experimental, and may be replaced, within the total tonnage limit prescribed in Article VII, without regard to its age.

ARTICLE IX

No aircraft carrier exceeding 27,000 tons (27,432 metric tons) standard displacement shall be acquired by, or constructed by, for, or within the jurisdiction of, any of the Contracting Powers.

However, any of the Contracting Powers may, provided that its total tonnage allowance of aircraft carriers is not thereby exceeded, build not more than two aircraft carriers, each of a tonnage of not more than 33,000 tons (33,528 metric tons) standard displacement, and in order to effect economy any of the Contracting Powers may use for this purpose any two of their ships, whether constructed or in course of construction, which would otherwise be scrapped under the provisions of Article II. The armament of any aircraft carriers exceeding 27,000 tons (27,432 metric tons) standard displacement shall be in accordance with the requirements of Article X, except that the total number of guns to be carried in case any of such guns be of a calibre exceeding 6 inches (152 millimetres), except anti-aircraft guns and guns not exceeding 5 inches (127 millimetres), shall not exceed eight.

ARTICLE X

No aircraft carrier of any of the Contracting Powers shall carry a gun with a calibre in excess of 8 inches (203 millimetres). Without prejudice to the provisions of Article IX, if the armament carried includes guns exceeding 6 inches (152 millimetres) in calibre the total number of guns carried, except anti-aircraft guns and guns not exceeding 5 inches (127 millimetres), shall not exceed ten. If alternatively the armament contains

no guns exceeding 6 inches (152 millimetres) in calibre, the number of guns is not limited. In either case the number of anti-aircraft guns and of guns not exceeding 5 inches (127 millimetres) is not limited.

ARTICLE XI

No vessel of war exceeding 10,000 tons (10,160 metric tons) standard displacement, other than a captial ship or aircraft carrier, shall be acquired by, or constructed by, for, or within the jurisdiction of, any of the Contracting Powers. Vessels not specifically built as fighting ships nor taken in time of peace under government control for fighting purposes, which are employed on fleet duties or as troop transports or in some other way for the purpose of assisting in the prosecution of hostilities otherwise than as fighting ships, shall not be within the limitations of this Article.

ARTICLE XII

No vessel of war of any of the Contracting Powers, hereafter laid down, other than a capital ship, shall carry a gun with a calibre in excess of 8 inches (203 millimetres).

ARTICLE XIII

Except as provided in Article IX, no ship designated in the present Treaty to be scrapped may be reconverted into a vessel of war.

ARTICLE XIV

No preparations shall be made in merchant ships in time of peace for the installation of warlike armaments for the purpose of converting such ships into vessels of war, other than the necessary stiffening of decks for the mounting of guns not exceeding 6 inch (152 millimetres) calibre.

ARTICLE XV

No vessel of war constructed within the jurisdiction of any of the Contracting Powers for a non-Contracting Power shall exceed the limitations as to displacement and armament prescribed by the present Treaty for vessels of a similar type which may be constructed by or for any of the Contracting Powers; provided, however, that the displacement for aircraft carriers constructed for a non-Contracting Power shall in no case exceed 27,000 tons (27,432 metric tons) standard displacement.

ARTICLE XVI

If the construction of any vessel of war for a non-Contracting Power is undertaken within the jurisdiction of any of the Contracting Powers, such Power shall promptly inform the other Contracting Powers of the date of the signing of the contract and the date on which the keel of the ship is laid; and shall also communicate to them the particulars relating to the ship prescribed in Chapter II, Part 3, Section I (b), (4) and (5).

ARTICLE XVII

In the event of a Contracting Power being engaged in war, such Power shall not use as a vessel of war any vessel of war which may be under con-

struction within its jurisdiction for any other Power, or which may have been constructed within its jurisdiction for another Power and not delivered.

ARTICLE XVIII

Each of the Contracting Powers undertakes not to dispose by gift, sale or any mode of transfer of any vessel of war in such a manner that such vessel may become a vessel of war in the Navy of any foreign Power.

ARTICLE XIX

The United States, the British Empire and Japan agree that the status quo at the time of the signing of the present Treaty, with regards to fortifications and naval bases, shall be maintained in their respective territories and possessions specified hereunder:

(1) The insular possessions which the United States now holds or may hereafter acquire in the Pacific Ocean, except (a) those adjacent to the coast of the United States, Alaska and the Panama Canal Zone, not including the Aleutian Islands, and (b) the Hawaiian Islands;

(2) Hongkong and the insular possessions which the British Empire now holds or may hereafter acquire in the Pacific Ocean, each of the meridian of 110° east longitude, except (a) those adjacent to the coast of Canada, (b) the Commonwealth of Australia and its Territories, and (c) New Zealand;

(3) The following insular territories and possessions of Japan in the Pacific Ocean, to wit: the Kurile Islands, the Bonin Islands, Amami-Oshima, the Loochoo Islands, Formosa and the Pescadores, and any insular territories or possessions in the Pacific Ocean which Japan may hereafter acquire.

The maintenance of the status quo under the foregoing provisions implies that no new fortifications or naval bases shall be established in the territories and possessions specified that no measures shall be taken to increase the existing naval facilities for the repair and maintenance of naval forces, and that no increase shall be made in the coast defences of the territories and possessions above specified. This restriction, however, does not preclude such repair and replacement of worn-out weapons and equipment as is customary in naval and military establishments in time of peace.

ARTICLE XX

The rules for determining tonnage displacement prescribed in Chapter II, Part 4, shall apply to the ships of each of the Contracting Powers.

CHAPTER II

RULES RELATING TO THE EXECUTION OF THE TREATY—DEFINITION OF TERMS

PART 1

CAPITAL SHIPS WHICH MAY BE RETAINED BY THE CONTRACTING POWERS

In accordance with Article II ships may be retained by each of the Contracting Powers as specified in this Part.

Ships which may be retained by the United States

Name:	Tonnage
Maryland	32,600
California	32,300
Tennessee	32,300
Idaho	32,000
New Mexico	32,000
Mississippi	32,000
Arizona	31,400
Pennsylvania	31,400
Oklahoma	27,500
Nevada	27,500
New York	27,000
Texas	27,000
Arkansas	26,000
Wyoming	26,000
Florida	21,825
Utah	21,825
North Dakota	20,000
Delaware	20,000
Total tonnage	500,650

On the completion of the two ships of the *West Virginia* class and the scrapping of the *North Dakota* and *Delaware*, as provided in Article II, the total tonnage to be retained by the United States will be 525,850 tons.

Ships which may be retained by the British Empire

Name:	Tonnage
Royal Sovereign	25,750
Royal Oak	25,750
Revenge	25,750
Resolution	25,750
Ramillies	25,750
Malaya	27,500
Valiant	27,500
Barham	27,500
Queen Elizabeth	27,500
Warspite	27,500
Benbow	25,000
Emperor of India	25,000
Iron Duke	25,000
Marlborough	25,000
Hood	41,200
Renown	26,500
Repulse	26,500
Tiger	28,500

Thunderer	22,500
King George V	23,000
Ajax	23,000
Centurion	23,000
Total tonnage	580,450

On the completion of the two new ships to be constructed and the scrapping of the *Thunderer, King George V, Ajax,* and *Centurion,* as provided in Article II, the total tonnage to be retained by the British Empire will be 558,950 tons.

Ships which may be retained by France

Name:	Tonnage (metric tons)
Bretagne	23,500
Lorrain	23,500
Provence	23,500
Paris	23,500
France	23,500
Jean Bart	23,500
Courbet	23,500
Condorcet	18,890
Diderot	18,890
Voltaire	18,890
Total tonnage	221,170

France may lay down new tonnage in the years 1927, 1929, and 1931, as provided in Part 3, Section II.

Ships which may be retained by Italy

Name:	Tonnage (metric tons)
Andrea Doria	22,700
Caio Duilio	22,700
Conte Di Cavour	22,500
Giulio Cesare	22,500
Leonardo Da Vinci	22,500
Dante Alighieri	19,500
Roma	12,600
Napoli	12,600
Vittorio Emanuele	12,600
Regina Elena	12,600
Total tonnage	182,800

Italy may lay down new tonnage in the years 1927, 1929, and 1931, as provided in Part 3, Section II.

Ships which may be retained by Japan

Name:	Tonnage
Mutsu	33,800
Nagato	33,800
Hiuga	31,260
Ise	31,260
Yamashiro	30,600
Fu-So	30,600
Kirishima	27,500
Haruna	27,500
Hiyei	27,500
Kongo	27,500
Total tonnage	301,320

PART 2

RULES FOR SCRAPPING VESSELS OF WAR

The following rules shall be observed for the scrapping of vessels of war which are to be disposed of in accordance with Articles II and III.

I. A vessel to be scrapped must be placed in such condition that it cannot be put to combatant use.

II. This result must be finally effected in any one of the following ways:

(a) Permanent sinking of the vessel;

(b) Breaking the vessel up. This shall always involve the destruction or removal of all machinery, boilers and armour, and all deck, side and bottom plating:

(c) Converting the vessel to target use exclusively. In such case all the provisions of paragraph III of this Part, except sub-paragraph (6), in so far as may be necessary to enable the ship to be used as a mobile target, and except sub-paragraph (7), must be previously complied with. Not more than one capital ship may be retained for this purpose at one time by any of the Contracting Powers.

(d) Of the capital ships which would otherwise be scrapped under the present Treaty in or after the year 1931, France and Italy may each retain two seagoing vessels for training purposes exclusively, that is, as gunnery or torpedo schools. The two vessels retained by France shall be of the *Jean Bart* class, and of those retained by Italy one shall be the *Dante Alighieri*, the other of the *Giulio Cesare* class. On retaining these ships for the purpose above stated, France and Italy respectively undertake to remove and restroy their conning-towers, and not to use the said ships as vessels of war.

III. (a) Subject to the special exceptions contained in Article IX, when a vessel is due for scrapping, the first stage of scrapping, which consists in rendering a ship incapable of further warlike service, shall be immediately undertaken.

(b) A vessel shall be considered incapable of further warlike service when there shall have been removed and landed, or else destroyed in the ship:

(1) All guns and essential portions of guns, fire-control tops and revolving parts of all barbettes and turrets;
(2) All machinery for working hydraulic or electric mountings;
(3) All fire-control instruments and range-finders;
(4) All ammunition, explosives and mines;
(5) All torpedoes, war-heads and torpedo tubes;
(6) All wireless telegraphy installations;
(7) The conning tower and all side armour, or alternatively all main propelling machinery; and
(8) All landing and flying-off platforms and all other aviation accessories.

IV. The periods in which scrapping of vessels is to be effected are as follows:

(a) In the case of vessels to be scrapped under the first paragraph of Article II, the work of rendering the vessels incapable of further warlike service, in accordance with paragraph III of this Part, shall be completed within six months from the coming into force of the present Treaty, and the scrapping shall be finally effected within eighteen months from such coming into force.

(b) In the case of vessels to be scrapped under the second and third paragraphs of Article II, or under Article III, the work of rendering the vessel incapable of further warlike service in accordance with paragraph III of this Part shall be commenced not later than the date of completion of its successor, and shall be finished within six months from the date of such completion. The vessel shall be finally scrapped, in accordance with paragraph II of this Part, within eighteen months from the date of completion of its successor. If, however, the completion of the new vessel be delayed, then the work of rendering the old vessel incapable of further warlike service in accordance with paragraph III of this Part shall be commenced within four years from the laying of the keel of the new vessel, and shall be finished within six months from the date on which such work was commenced, and the old vessel shall be finally scrapped in accordance with paragraph II of this Part within eighteen months from the date when the work of rendering it incapable of further warlike service was commenced.

Part 3

Replacement

The replacement of capital ships and aircraft carriers shall take place according to the rules in Section I and the tables in Section II of this Part.

SECTION I

RULES FOR REPLACEMENT

(a) Capital ships and aircraft carriers twenty years after the date of their completion may, except as otherwise provided in Article VIII and in the tables in Section II of this Part, be replaced by new construction, but within the limits prescribed in Article IV and Article VII. The keels of such new construction may, except as otherwise provided in Article VIII and in the tables in Section II of this Part, be laid down not earlier than seventeen years from the date of completion of the tonnage to be replaced, provided, however, that no capital ship tonnage, with the exception of the ships referred to in the third paragraph of Article II, and the replacement tonnage specifically mentioned in Section II of this Part, shall be laid down until ten years from November 12, 1921.

(b) Each of the Contracting Powers shall communicate promptly to each of the other Contracting Powers the following information:

(1) The names of the capital ships and aircraft carriers to be replaced by new construction;

(2) The date of governmental authorization of replacement tonnage;

(3) The date of laying the keels of replacement tonnage.

(4) The standard displacement in tons and metric tons of each new ship to be laid down, and the principal dimensions, namely, length at waterline, extreme beam at or below waterline, mean draft at standard displacement;

(5) The date of completion of each new ship and its standard displacement in tons and metric tons, and the principal dimensions, namely, length at waterline, extreme beam at or below waterline, mean draft at standard displacement, at time of completion.

(c) In case of loss or accidental destruction of capital ships or aircraft carriers, they may immediately be replaced by new construction subject to the tonnage limits prescribed in Articles IV and VII and in conformity with the other provisions of the present Treaty, the regular replacement program being deemed to be advanced to that extent.

(d) No retained capital ships or aircraft carriers shall be reconstructed except for the purpose of providing means of defense against air and submarine attack, and subject to the following rules: The Contracting Powers may, for that purpose, equip existing tonnage with bulge or blister or anti-air attack deck protection, providing the increase of displacement thus effected does not exceed 3,000 tons (3,048 metric tons) displacement for each ship. No alterations in side armour, in calibre, number or general type of mounting of main armament shall be permitted except:

(1) in the case of France and Italy, which countries within the limits allowed for bulge may increase their armor protection and the calibre of the guns now carried on their existing capital ships so as not to exceed 16 inches (406 millimeters) and

(2) the British Empire shall be permitted to complete, in the case of the *Renown*, the alterations to armour that have already been commenced but temporarily suspended.

SECTION II.

REPLACEMENT AND SCRAPPING OF CAPITAL SHIPS.

UNITED STATES.

Year.	Ships laid down.	Ships completed.	Ships scrapped (age in parentheses).	Ships retained. Summary. Pre-Jutland.	Ships retained. Summary. Post-Jutland.
			Maine (20) Missouri (20) Virginia (17) Nebraska (17) Georgia (17) New Jersey (17) Rhode Island (17) Connecticut (17) Louisiana (17) Vermont (16) Kansas (16) Minnesota (16) New Hampshire (15) South Carolina (13) Michigan (13) Washington (0) South Dakota (0) Indiana (0) Montana (0) North Carolina (0) Iowa (0) Massachusetts (0) Lexington (0) Constitution (0) Constellation (0) Saratoga (0) Ranger (0) United States (0).*	17	1
1922		A B†	Delaware (12) North Dakota (12)	15	3
1923				15	3
1924				15	3
1925				15	3
1926				15	3
1927				15	3
1928				15	3
1929				15	3
1930				15	3
1931	C D			15	3
1932	E F			15	3
1933	G			15	3
1934	H I	C D	Florida (23) Utah (23) Wyoming (22)	12	5
1935	J	E F	Arkansas (23) Texas (21) New York (21)	9	7
1936	K L	G	Nevada (20) Oklahoma (20)	7	8
1937	M	H I	Arizona (21) Pennsylvania (21)	5	10
1938	N O	J	Mississippi (21)	4	11
1939	P Q	K L	New Mexico (21) Idaho (20)	2	13
1940		M	Tennessee (20)	1	14
1941		N O	California (20) Maryland (20)	0	15
1942		P Q	2 ships West Virginia class	0	15

* The United States may retain the *Oregon* and *Illinois* for noncombatant purposes after complying with the provisions of Part 2 III (b).

† Two West Virginia class.

NOTE.—A B C D etc. represent individual capital ships of 35,000 tons standard displacement laid down and completed in the years specified.

REPLACEMENT AND SCRAPPING OF CAPITAL SHIPS—continued.

BRITISH EMPIRE.

Year.	Ships laid down.	Ships completed.	Ships scrapped (age in parentheses).	Ships retained. Summary. Pre-Jutland.	Ships retained. Summary. Post-Jutland.
			Commonwealth (16) Agamemnon (13) Dreadnought (15) Bellerophon (12) St. Vincent (11) Inflexible (13) Superb (12) Neptune (10) Hercules (10) Indomitable (13) Temeraire (12) New Zealand (9) Lion (9) Princess Royal (9) Conquerer (9) Monarch (9) Orion (9) Australia (8) Agincourt (7) Erin (7) 4 building or projected.*	21	1
1922	A. B†			21	1
1923				21	1
1924				21	1
1925		A. B	King George V (13) Ajax (12) Centurion (12) Thunderer (13).	17	3
1926				17	3
1927				17	3
1928				17	3
1929				17	3
1930				17	3
1931	C. D			17	3
1932	E. F			17	3
1933	G			17	3
1934	H. I	C. D	Iron Duke (20) Marlborough (20) Emperor of India (20) Benbow (20).	13	5
1935	J	E. F	Tiger (21) Queen Elizabeth (20) Warspite (20) Barham (20).	9	7
1936	K. L	G	Malaya (20) Royal Sovereign (20)	7	8
1937	M	H. I	Revenge (21) Resolution (21)	5	10
1938	N. O	J	Royal Oak (22)	4	11
1939	P Q	K. L	Valiant (23) Repulse (23)	2	13
1940		M	Renown (24)	1	14
1941		N. O	Ramillies (24) Hood (21)	0	15
1942		P. Q	A (17) B (17)	0	15

* The British Empire may retain the *Colossus* and *Collingwood* for noncombatant purposes after complying with the provisions of Part 2 III (b).

† Two 35,000-ton ships standard displacement.

NOTE.—A B C D etc. represent individual capital ships of 35,000 tons standard displacement laid down and completed in the years specified.

REPLACEMENT AND SCRAPPING OF CAPITAL SHIPS—continued.

FRANCE.

Year.	Ships laid down.	Ships Completed.	Ships scrapped (age in parentheses).	Ships retained. Summary. Pre-Jutland.	Ships retained. Summary. Post-Jutland.
1922				7	0
1923				7	0
1924				7	0
1925				7	0
1926				7	0
1927	35,000 tons			7	0
1928				7	0
1929	35,000 tons			7	0
1930		35,000 tons	Jean Bart (17) Courbet (17)	5	(*)
1931	35,000 tons			5	(*)
1932	35,000 tons	35,000 tons	France (18)	4	(*)
1933	35,000 tons			4	(*)
1934		35,000 tons	Paris (20) Bretagne (20)	2	(*)
1935		35,000 tons	Provence (20)	1	(*)
1936		35,000 tons	Lorraine (20)	0	(*)
1937				0	(*)
1938				0	(*)
1939				0	(*)
1940				0	(*)
1941				0	(*)
1942				0	(*)

* Within tonnage limitations; number not fixed.

NOTE.—France expressly reserves the right of employing the capital ship tonnage allotment as she may consider advisable subject solely to the limitations that the displacement of individual ships should not surpass 35,000 tons and that the total capital ship tonnage should keep within the limit imposed by the present Treaty.

ITALY.

Year.	Ships laid down.	Ships completed.	Ships scrapped (age in parentheses).	Ships retained. Summary.	
				Pre-Jutland.	Post-Jutland.
1922				6	0
1923				6	0
1924				6	0
1925				6	0
1926				6	0
1927	35,000 tons			6	0
1928				6	0
1929	35,000 tons			6	0
1930				6	0
1931	35,000 tons	35,000 tons	Dante Alighieri (19)	5	(*)
1932	45,000 tons			5	(*)
1933	25,000 tons	35,000 tons	Leonardo da Vinci (19)	4	(*)
1934				4	(*)
1935		35,000 tons	Guilio Cesare (21)	3	(*)
1936		45,000 tons	Conte di Cavour (21) Duilio (21)	1	(*)
1937		25,000 tons	Andrea Doria (21)	0	(*)

* Within tonnage limitations; number not fixed.

NOTE.—Italy expressly reserves the right of employing the capital ship tonnage allotment as she may consider advisable subject solely to the limitations that the displacement of individual ships should not surpass 35,000 tons and the total capital ship tonnage should keep within the limits imposed by the present Treaty.

REPLACEMENT AND SCRAPPING OF CAPITAL SHIPS—continued.

JAPAN.

Year	Ships laid down.	Ships completed.	Ships scrapped (age in parentheses).	Ships retained. Summary.	
				Pre-Jutland.	Post-Jutland.
			Hizen (20) Mikasa (20) Kashima (16) Katori (16) Satsuma (12) Aki (11) Settsu (10) Ikoma (14) Ibuki (12) Kurama (11) Amagi (0) Akagi (0) Kaga (0) Tosa (0) Takao (0) Atago (0). Projected program 8 ships not laid down.*	8	
1922				8	2
1923				8	2
1924				8	2
1925				8	2
1926				8	2
1927				8	2
1928				8	2
1929				8	2
1930				8	2
1931	A			8	2
1932	B			8	2
1933	C			8	2
1934	D	A	Kongo (21)	7	3
1935	E	B	Hiyei (21) Haruna (20)	5	4
1936	F	C	Krishima (21)	4	5
1937	G	D	Fuso (22)	3	6
1938	H	E	Yamashiro (21)	2	7
1939	I	F	Ise (22)	1	8
1940		G	Hiuga (22)	0	9
1941		H	Nagato (21)	0	9
1942		I	Mutsu (21)	0	9

* Japan may retain the *Shikishima* and *Asahi* for noncombatant purposes after complying with the provisions of Part 2 III (b).

NOTE.—A B C D etc. represent individual capital ships of 35,000 tons standard displacement laid down and completed in the years specified.

NOTE APPLICABLE TO ALL THE TABLES IN SECTION II

The order above prescribed in which ships are to be scrapped is in accordance with their age. It is understood that when replacement begins according to the above tables the order of scrapping in the case of the ships of each of the Contracting Powers may be varied at its option; provided, however, that such Power shall scrap in each year the number of ships above stated.

PART 4
DEFINITIONS

For the purposes of the present Treaty, the following expressions are to be understood in the sense defined in this Part.

CAPITAL SHIP

A capital ship, in the case of ships hereafter built, is defined as a vessel of war, not an aircraft carrier, whose displacement exceeds 10,000 tons (10,160 metric tons) standard displacement, or which carries a gun with a calibre exceeding 8 inches (203 millimetres).

AIRCRAFT CARRIER

An aircraft carrier is defined as a vessel of war with a displacement in excess of 10,000 tons (10,160 metric tons) standard displacement designed for the specific and exclusive purpose of carrying aircraft. It must be so constructed that aircraft can be launched therefrom and landed thereon, and not designed and constructed for carrying a more powerful armament than that allowed to it under Article IX or Article X as the case may be.

STANDARD DISPLACEMENT

The standard displacement of a ship is the displacement of the ship complete, fully manned, engined, and equipped ready for sea, including all armament and ammunition, equipment, outfit, provisions and fresh water for crew, miscellaneous stores and implements of every description that are intended to be carried in war, but without fuel or reserve feed water on board.

The word "ton" in the present Treaty, except in the expression "metric tons," shall be understood to mean the ton of 2240 pounds (1016 kilos).

Vessels now completed shall retain their present ratings of displacement tonnage in accordance with their national system of measurement. However, a Power expressing displacement in metric tons shall be considered for the application of the present Treaty as owning only the equivalent displacement in tons of 2240 pounds.

A vessel completed hereafter shall be rated at its displacement tonnage when in the standard condition defined herein.

CHAPTER III

MISCELLANEOUS PROVISIONS

ARTICLE XXI

If during the term of the present Treaty the requirements of the national security of any Contracting Power in respect of naval defence are, in the opinion of that Power, materially affected by any change of circumstances, the Contracting Powers will, at the request of such Power, meet in conference with a view to the reconsideration of the provisions of the Treaty and its amendment by mutual agreement.

In view of possible technical and scientific developments, the United States, after consultation with the other Contracting Powers, shall arrange

for a conference of all the Contracting Powers which shall convene as soon as possible after the expiration of eight years from the coming into force of the present Treaty to consider what changes, if any, in the Treaty may be necessary to meet such developments.

ARTICLE XXII

Whenever any Contracting Power shall become engaged in a war which in its opinion affects the naval defence of its national security, such Power may after notice to the other Contracting Powers suspend for the period of hostilities its obligations under the present Treaty other than those under Articles XIII and XVII, provided that such Power shall notify the other Contracting Powers that the emergency is of such a character as to require such suspension.

The remaining Contracting Powers shall in such case consult together with a view to agreement as to what temporary modifications if any should be made in the Treaty as between themselves. Should such consultation not produce agreement, duly made in accordance with the constitutional methods of the respective Powers, any one of said Contracting Powers may, by giving notice to the other Contracting Powers, suspend for the period of hostilities its obligations under the present Treaty, other than those under Articles XIII and XVII.

On the cessation of hostilities the Contracting Powers will meet in conference to consider what modifications, if any, should be made in the provisions of the present Treaty.

ARTICLE XXIII

The present Treaty shall remain in force until December 31st, 1936, and in case none of the Contracting Powers shall have given notice two years before that date of its intention to terminate the Treaty, it shall continue in force until the expiration of two years from the date on which notice of termination shall be given by one of the Contracting Powers, whereupon the Treaty shall terminate as regards all the Contracting Powers. Such notice shall be communicated in writing to the Government of the United States, which shall immediately transmit a certified copy of the notification to the other Powers and inform them of the date on which it was received. The notice shall be deemed to have been given and shall take effect on that date. In the event of notice of termination being given by the Government of the United States, such notice shall be given to the diplomatic representatives at Washington of the other Contracting Powers, and the notice shall be deemed to have been given and shall take effect on the date of the communication made to the said diplomatic representatives.

Within one year of the date on which a notice of termination by any Power has taken effect, all the Contracting Powers shall meet in conference.

ARTICLE XXIV

The present Treaty shall be ratified by the Contracting Powers in accordance with their respective constitutional methods and shall take effect

on the date of the deposit of all the ratifications, which shall take place at Washington as soon as possible. The Government of the United States will transmit to the other Contracting Powers a certified copy of the procès-verbal of the deposit of ratifications.

The present Treaty, of which the French and English texts are both authentic, shall remain deposited in the archives of the Government of the United States, and duly certified copies thereof shall be transmitted by that Government to the other Contracting Powers.

In faith whereof the above-named Plenipotentiaries have signed the present Treaty.

Done at the City of Washington the sixth day of February, One Thousand Nine Hundred and Twenty-Two.

CHARLES EVANS HUGHES	ARTHUR JAMES BALFOUR
HENRY CABOT LODGE	V. S. SRINIVASA SASTRI
OSCAR W. UNDERWOOD	A. SARRAUT
ELIHU ROOT	JUSSERAND
ARTHUR JAMES BALFOUR	CARLO SCHANZER
LEE OF FAREHAM	V. ROLANDI RICCI
A. C. GEDDES	LUIGI ALBERTINI
R. L. BORDEN	T. KATO
G. F. PEARCE	K. SHIDEHARA
JOHN W. SALMOND	M. HANIHARA.

(2) A TREATY BETWEEN THE SAME POWERS, IN RELATION TO THE USE OF SUBMARINES AND NOXIOUS GASES IN WARFARE.

The United States of America, the British Empire, France, Italy and Japan, hereinafter referred to as the Signatory Powers, desiring to make more effective the rules adopted by civilized nations for the protection of the lives of neutrals and noncombatants at sea in time of war, and to prevent the use in war of noxious gases and chemicals, have determined to conclude a Treaty to this effect, and have appointed as their Plenipotentiaries:

The President of the United States of America:

Charles Evans Hughes,
Henry Cabot Lodge,
Oscar W. Underwood,
Elihu Root,
citizens of the United States;

His Majesty the King of the United Kingdom of Great Britain and Ireland and of the British Dominions beyond the Seas, Emperor of India;

The Right Honourable Arthur James Balfour, O.M., M.P., Lord President of His Privy Council;

The Right Honourable Baron Lee of Fareham, G.B.E., K.C.B., First Lord of His Admiralty;

The Right Honourable Sir Auckland Campbell Geddes, K.C.B., His Ambassador Extraordinary and Plenipotentiary to the United States of America;

and

for the Dominion of Canada:

The Right Honourable Sir Robert Laird Borden, G.C.M.G., K.C.:

for the Commonwealth of Australia:

Senator, the Right Honourable George Foster Pearce, Minister for Home and Territories;

for the Dominion of New Zealand:

The Honourable Sir John William Salmond, K.C., Judge of the Supreme Court of New Zealand;

for the Union of South Africa:

The Right Honourable Arthur James Balfour, O.M., M.P.;

for India:

The Right Honourable Valingman Sankaranarayana Srinivasa Sastri, Member of the Indian Council of State;

The President of the French Republic:

Mr. Albert Sarraut, Deputy, Minister of the Colonies;

Mr. Jules J. Jusserand, Ambassador Extraordinary and Plenipotentiary to the United States of America, Grand Cross of the National Order of the Legion of Honour;

His Majesty the King of Italy:

The Honourable Carlo Schanzer, Senator of the Kingdom;

The Honourable Vittorio Rolandi Ricci, Senator of the Kingdom, His Ambassador Extraordinary and Plenipotentiary at Washington;

The Honourable Luigi Albertini, Senator of the Kingdom;

His Majesty the Emperor of Japan:

Baron Tomosaburo Kato, Minister for the Navy, Junii, a member of the First Class of the Imperial Order of the Grand Cordon of the Rising Sun with the Paulownia Flower;

Baron Kijuro Shidehara, His Ambassador Extraordinary and Plenipotentiary at Washington, Joshii, a member of the First Class of the Imperial Order of the Rising Sun;

Mr. Masanao Hanihara, Vice Minister for Foreign Affairs, Jushii, a member of the Second Class of the Imperial Order of the Rising Sun;

Who, having communicated their Full Powers, found in good and due form, have agreed as follows:

ARTICLE I

The Signatory Powers declare that among the rules adopted by civilized nations for the protection of the lives of neutrals and noncombatants at sea in time of war, the following are to be deemed an established part of international law;

(1) A merchant vessel must be ordered to submit to visit and search to determine its character before it can be seized.

A merchant vessel must not be attacked unless it refuse to submit to visit and search after warning, or to proceed as directed after seizure.

A merchant vessel must not be destroyed unless the crew and passengers have been first placed in safety.

(2) Belligerent submarines are not under any circumstances exempt from the universal rules above stated; and if a submarine can not capture a merchant vessel in conformity with these rules the existing law of nations requires it to desist from attack and from seizure and to permit the merchant vessel to proceed unmolested.

ARTICLE II

The Signatory Powers invite all other civilized Powers to express their assent to the foregoing statement of established law so that there may be a clear public understanding throughout the world of the standards of conduct by which the public opinion of the world is to pass judgment upon future belligerents.

ARTICLE III

The Signatory Powers, desiring to insure the enforcement of the humane rules of existing law declared by them with respect to attacks upon and the seizure and destruction of merchant ships, further declare that any person in the service of any Power who shall violate any of those rules, whether or not such person is under orders of a governmental superior, shall be deemed to have violated the laws of war and shall be liable to trial and punishment as if for an act of piracy and may be brought to trial before the civil or military authorities of any Power within the jurisdiction of which he may be found.

ARTICLE IV

The Signatory Powers recognize the practical impossibility of using submarines as commerce destroyers without violating, as they were violated in the recent war of 1914-1918, the requirements universally accepted by civilized nations for the protection of the lives of neutrals and noncombatants, and to the end that the prohibition of the use of submarines as commerce destroyers shall be universally accepted as a part of the law of nations they now accept that prohibition as henceforth binding as between themselves and they invite all other nations to adhere thereto.

ARTICLE V

The use in war of asphyxiating, poisonous or other gases, and all analogous liquids, materials or devices, having been justly condemned by the general opinion of the civilized world and a prohibition of such use having been declared in treaties to which a majority of the civilized Powers are parties,

The Signatory Powers, to the end that this prohibition shall be universally accepted as a part of international law binding alike the conscience and practice of nations, declare their assent to such prohibition, agree to be bound thereby as between themselves and invite all other civilized nations to adhere thereto.

ARTICLE VI

The present Treaty shall be ratified as soon as possible in accordance with the constitutional methods of the Signatory Powers and shall take effect on the deposit of all the ratifications, which shall take place at Washington.

The Government of the United States will transmit to all the Signatory Powers a certified copy of the procès-verbal of the deposit of ratifications.

The present Treaty, of which the French and English texts are both authentic, shall remain deposited in the Archives of the Government of the United States, and duly certified copies thereof will be transmitted by that Government to each of the Signatory Powers.

ARTICLE VII

The Government of the United States will further transmit to each of the Non-Signatory Powers a duly certified copy of the present Treaty and invite its adherence thereto.

Any Non-Signatory Power may adhere to the present Treaty by communicating an Instrument of Adherence to the Government of the United States, which will thereupon transmit to each of the Signatory and Adhering Powers a certified copy of each Instrument of Adherence.

In faith whereof, the above named Plenipotentiaries have signed the present Treaty.

Done at the City of Washington, the sixth day of February, one thousand nine hundred and twenty-two.

[L. S.] CHARLES EVANS HUGHES
[L. S.] HENRY CABOT LODGE
[L. S.] OSCAR W. UNDERWOOD
[L. S.] ELIHU ROOT
[L. S.] ARTHUR JAMES BALFOUR
[L. S.] LEE OF FAREHAM
[L. S.] A. C. GEDDES
R. L. BORDEN [L. S.]
G. F. PEARCE [L. S.]
JOHN W. SALMOND [L. S.]
ARTHUR JAMES BALFOUR [L. S.]
V. S. SRINIVASA SASTRI [L. S.]
A. SARRAUT [L. S.]
JUSSERAND [L. S.]
CARLO SCHANZER [L. S.]
[L. S.] V. ROLANDI RICCI
[L. S.] LUIGI ALBERTINI
[L. S.] T. KATO
[L. S.] K. SHIDEHARA
[L. S.] M. HANIHARA

RICHARD WAINWRIGHT
1849-1926

In Memoriam

AGAIN does the Naval Institute honor itself in rendering tribute to the memory of one who was both a former president and prize essayist, and known the world over for his distinguished professional attainments and fighting qualities.

In the death of Rear Admiral Wainwright, the Naval Institute has lost one of its staunchest and most active friends. His contributions to the pages of its PROCEEDINGS have covered a wide range of professional subjects, beginning as early as 1882 and continuing to a few months ago, his last article having been entitled "The Dacia Dilemma." His article "Tactical Problems in Naval Warfare" was the prize essay in 1895. The years of thought and study spent in the mastery of his profession were no doubt the deciding factors which led to his selection as the first Aide for Operations upon the reorganization of the Navy Department in 1909.

Perhaps the greatest tribute that can be rendered to his memory and which best gives an insight to his character is to quote Theodore Roosevelt when referring to the battle of Santiago: "The most striking act was that of the *Gloucester,* a converted yacht, which her commander, Wainwright, pushed into the fight through a hail of projectiles, any one of which would have sunk her, in order that he might do his part in destroying the two torpedo boats, each possessing more than his own offensive power."

SECRETARY'S NOTES

Circulation

The circulation of the PROCEEDINGS, since January 1926, has increased 359 copies. During the past month the circulation has increased 107 copies.

The membership of the Institute has increased, since January 1926, 228 members, of which 104 joined the preceding month.

Naval Historical Foundation

Elsewhere in this issue will be found the Minutes of the organization of the Naval Historical Foundation and the record of its incorporation, together with its By-Laws and the names of its officials. The address of the Foundation for the present is care of the Office of Naval Records and Library, Navy Department, Washington, D. C. The Institute's check for $1,000 has been paid to the Foundation's Trust Fund.

New Books

During the past month the Institute published a new book entitled *Engineering Materials and Processes,* by Lieutenant Commander G. B. Ashe, U. S. Navy, and Lieutenant Commander J. I. Hale, (CC) U. S. Navy, of the Department of Engineering and Aeronautics, U. S. Naval Academy. The price is $3.90, postpaid. This book replaces Danforth's *Mechanical Processes* at the Naval Academy. It is the intention of the Institute to publish a companion volume entitled *Shop Practices.*

The *Dardanelles Expedition,* by Captain W. D. Puleston, U. S. Navy, a description of which appeared in the April issue and again in this number, will be off the press about May 1. The book will be handsomely bound in semi-flexible red buckram. The price is $2.50, but a reduction of 20 per cent will be allowed in certain cases. See page following page 1082.

Communications

Attention is invited to the article entitled "Military Communications," by Lieutenant Commander B. S. Bullard, (CC) U. S. Navy, and to the article entitled "International Electrical Communications," by Walter S. Rogers, page 1044. Communications is becoming a subject of ever increasing importance to the Navy; and it might be of interest to add that, due to the great importance attached to this subject by naval aviation, the course at the Naval Academy, together with the postgraduate course of instruction in aviation and aeronautics each summer, tends toward future graduates of the Academy becoming experts in blinker and radio code upon their joining the fleets. See also page 1005.

Admiral Luce

The April number contained a review by Captain Harris Laning, U. S. Navy, of Rear Admiral Gleaves' book entitled *The Life and Letters of Admiral Stephen B. Luce, U. S. Navy*, and this issue contains a review of the book by Rear Admiral Sidney A. Staunton, U. S. Navy (retired).

The Washington Disarmament Treaties

In view of the approaching Disarmament Conference at Geneva, and in order that the Institute's members and subscribers may have at hand for ready reference, there is included elsewhere in this issue, page 1057, a copy of the Washington Treaties Limiting Naval Armament, together with a copy of the Treaty in Relation to Submarines and Noxious Gases in Warfare.

Captain Dungan Resigns

Due to receipt of orders involving detachment, Captain Paul B. Dungan, U. S. Navy, has resigned as a member of the Board of Control of the Institute, and Commander Robert A. Theobald, U. S. Navy, has been elected to succeed him.

The Yorktown Frontispiece

Perhaps the frontispiece will recall to some of our readers many interesting events of this historic ship that are unknown to and might prove of interest to the present generation.

Aviation for Junior Line Officers Royal Navy

Attention is invited to the Professional Notes Section, page 1030, of this issue, which indicates that junior line officers of the Royal Navy are to receive instruction in aviation and aeronautics.

Naval Academy Graduates' Reunion and Dinner May 29

The Institute is very glad to give publicity to the following notice from the Secretary-Treasurer of the U. S. Naval Academy Graduates' Association, Annapolis, Maryland, which is addressed to all graduates of the U. S. Naval Academy:

FELLOW GRADUATES:

"Two years have passed since our last reunion. On May 31, 1924, between 600 and 700 graduates turned their footsteps into a well known path and came back to visit their Alma Mater, and to see the Navy baseball team roll back the Army in a right proper fashion. There is no doubt but that the presence of those old grads was an inspiration to the midshipmen, and may have been one of the deciding factors in that victory.

Last year the Army-Navy game was played at West Point, but this year, 1926, it is again to be played in Annapolis. Your Council thinks this is the time for another "get-together." Washington and the Academy officials are in thorough accord with the idea. It now rests with each individual graduate to add one more to the roll who will answer "Present" at formation.

The reunion and dinner will be held *Saturday* evening, *May 29, 1926,* in Bancroft Hall, Naval Academy. The following is the schedule of events for that day:

10:00 A.M. Rifle: 71st Regiment, N. Y. N. G.
10:00 A.M. Tennis: University of Penn, at Naval Academy.
2:30 P.M. Army-Navy baseball game, Lawrence Field.
2:30 P.M. Army-Navy track meet, Lawrence Field. The two events will be run off at the same time.
7:00 P.M. Formation for dinner. Blake Road, facing the Chapel; Senior Class on the right.
Roll Call by Classes.
"Navy four N" Yell.
7:30 P.M. March to Dinner.
7:30-9:00 P.M. Dinner.
9:00 P.M. Annual Meeting.
9:30 P.M. Toasts and Songs.
10:45 P.M. March to Midshipmen's Hop, Dahlgren Hall.

Uniform for dinner—Dinner dress or ordinary "cits."

IMPORTANT NOTICE: Speeches at the Dinner will be strictly limited as to number, and more strictly limited as to length. Five minutes each, *no more.*

GENERAL INFORMATION

1. Notify Secretary-Treasurer at earliest practicable date, saying "I'll be there." The dinner charge will be $3.50. Send check or money-order to the Secretary-Treasurer. See address at end of this notice.

2. Make early application to Navy Athletic Association for tickets for baseball game. You will sit with your class. All graduates will be given tickets.

3. A small quota of tickets will be held for those graduates who arrive at the last moment and have no tickets.

4. A limited number of bachelor accommodations will be available in Bancroft Hall for Saturday night. Definite requests should be made well in advance to the Commandant of midshipmen. Rooms will be assigned according to date of graduation. Those desiring to room together should so state in their application for accommodations. Those desiring accommodations prior to Saturday night, or extending over the week end, should write to the Commandant. Further, those quartered in Bancroft Hall can take their meals at special tables in the regular mess hall, at the regular time. Cost of meals 50 cents each. A short notice will be all that is necessary.

5. If necessary, special cars to Baltimore and Washington can be arranged for graduates after the dinner. Indicate desire for late transportation on the postal card sent to members.

6. The reception committee of the Graduates' Council will be on hand ready and willing to give special consideration to any wish or desire of those graduates who will come to Annapolis on May 29.

There will be established (see sign) at Maryland Avenue Gate an information bureau for graduates.

The purpose of this bureau is to:

a) Furnish any desired information as to housing, refreshments, location of friends, etc.

b) Information relative to events of the day.

c) Information relative to tickets; location of seats, etc., for the baseball game.

d) Furnish guides for those unfamiliar with the new Academy, if desired.

It is requested that all visiting graduates, especially those not in unform, enter at the Maryland Avenue gate, visit the bureau to register, receive information as to events of the day, and to receive an identification badge for themselves and members of families which will enable the reception committee to see that they receive all consideration and courtesies at our command. While not necessary to register, it would be much appreciated if all would do so, that a record might be kept of attendance on this occasion.

The Secretary-Treasurer still has on hand some copies of the 1925 edition of the Graduates' Register. Those who have not had a copy or desire additional copies can obtain them from him at $1.00 per copy, postage free.

There was a large reunion two years ago. Let us get together and make it a larger one this year. The one idea of the Council and the officers of the Naval Academy, is to make it as easy as possible for you to come, and to make your stay so pleasant that you will find it difficult to get away. Remember: speeches at the dinner are to be few in number and beautifully short.

We are but a relatively small group here. We will do all that is possible to make this year's reunion a success, but we do need, and hereby ask for, the hearty co-operation of every graduate. COME yourself and get all the "grads" who live near you to come. You will get a warm welcome at the "old main gate" of the Academy when you arrive.

A problem in Arithmetic: Subtract the date of your graduation from 1936, if the remainder is divisible by 5, it is more than ever necessary that you get here.

By direction of the Council:

COL. R. M. THOMPSON, 68.
W. W. PHELPS, '89, *Rear Admiral.*
R. M. WATT, '91, *Captain* (C. C.).
D. M. GARRISON, '95, *Captain* (Math.) Retired.
W. S. ANDERSON, '03, *Captain.*
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